U.S. NUCLEAR REGULATORY COMMISSION

STANDARD REVIEW PLAN

11.5 PROCESS AND EFFLUENT RADIOLOGICAL MONITORING INSTRUMENTATION AND SAMPLING SYSTEMS

REVIEW RESPONSIBILITIES

Primary - Organization responsible for the review of the design and performance of radiation monitoring instrumentation and sampling systems used to monitor and control radioactivity in process streams and effluent releases from radioactive waste management systems.

Secondary - Organization responsible for the review of instrumentation and control design features, including alarm and automatic control functions.

I. AREAS OF REVIEW

For a review~~s~~ of an early site permit (ESP), construction permit (CP), standard design certification (DC), or a combined license (COL) that does not reference a DC, the U.S. Nuclear Regulatory Commission (NRC) staff reviews the information in the applicant's Safety Analysis Report (Preliminary Safety Analysis Report (PSAR) or Final Safety Analysis Report (FSAR)) as it relates to the process and effluent radiological monitoring instrumentation and sampling systems (PERMISS). For operating licenses (OL) or COLs that reference a DC, the staff confirms that the information accepted at the CP or standard DC stage is appropriately

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incorporated in the relevant sections of OL or COL applications, and that proposed departures are adequately justified and documented.

This section of the staff's Standard Review Plan (SRP) addresses the evaluation of plant systems used to control, monitor, and sample process and effluent streams before being treated and released from pressurized water reactors (PWRs) and boiling water reactors (BWRs). The staff's evaluation assesses whether an applicant demonstrates compliance with regulatory limits on radioactive effluent discharges and associated doses to members of the public in ensuring that releases and doses are "as low as is reasonably achievable" (ALARA).

In PWRs and BWRs, the PERMISS is used to monitor liquid and gaseous process streams and effluents from the liquid waste management system (LWMS), gaseous waste management system (GWMS), and solid waste management system (SWMS). These systems are collectively referred to as radioactive waste management systems (RWMS). The PERMISS includes systems used to collect process and effluent samples during normal operation and anticipated operational occurrences (AOOs) and under accident and post-accident conditions under Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, Appendix A, General Design Criteria (GDC) 60, "Control of Releases of Radioactive Materials to the Environment," and GDC 64, "Control of Releases of Radioactive Materials to the Environment," the design basis of the PERMISS is important in demonstrating compliance with 10 CFR Part 20, "Standards for Protection against Radiation," dose limits for members of the public and should reflect the importance of these safety functions. As such, the review of the PERMISS must be sufficient to assure that the staff has reasonable assurance that public health and safety are adequately protected under NRC regulations.

Typically, radiation monitoring systems consist of one or more remote monitors; a centrally located cabinet or console where data from radiation detectors are received, recorded, converted to meaningful radiological units, and displayed in the control room. Other hardware include necessary interconnecting cables, power supplies, actuators and motors, sampling pumps, alarms, recorders, display panels, and other auxiliary components. Some monitoring systems designs rely on the placement of a radiation detector near or within the effluent streams in achieving the same function without diverting any portion of the effluent stream. In specific applications, radiation monitoring systems are used to automatically initiate a protective action when exceeding a defined instrumentation alarm set-point, such as in terminating or diverting a process stream or effluent releases.

Nonsafety-related systems include radiological monitoring instrumentation that serves to control and monitor radioactivity levels and radioactive releases, including monitoring systems that support process streams, ambient airborne concentrations in plant areas, plant systems integrity, and building ventilation systems servicing plant facilities housing irradiated fuel, demineralizers and filters, waste management equipment (as permanently installed or skid-mounted), and radioactive wastes and materials held in storage.

For radiation monitoring systems that supports safety-related functions, as identified by the applicant, the review of these design features and operating characteristics is performed using the guidance in SRP Chapter 7, "Instrumentation and Controls Overview of Review Process," BTP 7-10, "Guidance on Application of Regulatory Guide 1.97," and SRP Section 13.3, "Emergency Planning." In this context, the review, using Regulatory Guide (RG) 1.97, "Criteria for Accident Monitoring Instrumentation for Nuclear Power Plants," and Institute of Electrical and

Electronics Engineers (IEEE) Std. 497-2002, “IEEE Standard Criteria for Accident Monitoring Instrumentation for Nuclear Power Generating Stations,” issued 2002; and IEEE Std. 603-1991, “IEEE Standard Criteria for Safety Systems for Nuclear Power Generating Stations,” issued 1991, addresses the performance, design, qualification, display, quality assurance (QA), and selection of monitoring variables of radiation monitoring equipment required for accident monitoring and sampling. Radiological monitoring instrumentation systems used to initiate control room habitability functions and containment isolation are classified as safety-related. While these aspects are not discussed in this SRP section, the review conducted here compares the monitoring instrumentation and performance criteria of RG 1.97 and confirms that such instrumentation can provide complementary functions for systems that are used to comply with the requirements of 10 CFR Part 20 and 10 CFR Part 50. For radiation monitoring systems that support nonsafety Three Mile Island (TMI) accident-related functions, the review of the design features and operating characteristics is performed using the guidance of RG 1.97 and industry standards, which address the performance, display, and monitoring functions required during accident conditions.

For the nonsafety-related portions of the PERMISS, the review addresses the types and placement of radiation monitoring equipment in plant systems and facilities, operational ranges and qualification of radiation detectors in supporting the functions of monitoring systems, and functional interdependence and logic in alarming and terminating or diverting process or effluent streams. The applicant's technical submittal must provide sufficient information to confirm that the operation of the PERMISS and any failure of essential systems will not compromise public health and safety under 10 CFR Part 20 in complying with dose limits for members of the public and effluent concentration limits in unrestricted areas.

The specific areas of review include the following topics:

1. The design objectives and criteria for the PERMISS, including the interface with skid-mounted radiation monitoring and sampling equipment connected to permanently installed systems. The review identifies the (1) process and effluent streams to be monitored by radiation detection instrumentation or sampled for separate analyses, (2) purpose of each monitoring or sampling function, and (3) parameters to characterize, through monitoring instrumentation or sampling and analysis, radionuclide distributions and concentrations in sampled process and effluent streams (e.g., total gross beta-gamma or alpha activity, radionuclide-specific concentrations or inventories, isotopic analyses for halogens and noble gases, and radioactivity levels or inventories by groupings of radionuclides).

2. The system description for the PERMISS includes the following:

    A. Descriptions of radiation measurement instrumentation and related sampling equipment, including redundancy and independence (where applicable); instrumentation dynamic response range, calibration, and sensitivity; methods for determining alarm/trip setpoints for activating alarms and for terminating effluent releases or isolating processes; types and placement of detector check sources; basis for in-plant effluent dilution flow rates; and diversity of components used in monitoring normal operations, AOOs, and postulated accidents.

B. Location of radiation instrumentation, monitors, and direct readouts (local and control room), including the proposed locations and interface with skid-mounted radiation monitoring equipment.

C. Location and basis of selected sampling points and sampling stations using NRC and industry technical guidance in ensuring the collection of representative samples, while minimizing losses or deposition in sampling lines.

D. Methods used to convert raw instrumentation readings into meaningful radiological results to identify radioactivity or radionuclide concentrations monitored or sampled for normal operations, AOOs, and postulated accidents in assessing radioactivity levels, concentrations, exposure rates, and doses in confirming compliance with NRC criteria and guidance.

E. Measurements, analyses, and determinations, including the basis for the interpretation of the results of sample analyses, relying on the use of surrogate radionuclides, as easy-to-detect in accounting for the presence of hard-to-detect radionuclides when not specifically analyzed. Parallel determinations may be conducted using gross beta-gamma or alpha concentrations in inferring the concentrations of specific radionuclides.

F. Descriptions of instrumentation calibration methods and procedures in confirming instrumentation response characteristics, sensitivity levels and detection limits, and detection ranges for plant-derived radionuclides expected during normal operation, AOOs, and accident conditions. Comparison of the types, levels and concentrations of radioactive materials described as the design basis of the plant to methods described for specifying the types and ranges of radiation monitoring instrumentation. When two or more radiation monitoring systems are used for accident monitoring on a single discharge point, differences in instrumentation response characteristics should be described over their expected overlapping operational ranges for noble gases, particulates, and radioiodines.

G. Types and locations of annunciations and alarms and actions initiated by each type of instrumentation, and confirmation that once tripped by an alarm setpoint, the instrumentation system properly initiates and completes the expected action, such as terminating or diverting a release or process, and, if part of the design, controls in monitoring deviations of in-plant dilution and exhaust flow rates and terminating releases or isolating process flows when deviations exceed preset limits.

H. Provisions for sample collection and analysis, including sampling lines and valves, in characterizing radionuclide concentrations in process streams and effluent releases. Basis for the sampling and analysis program, including sample collection frequency, and types of radiological analysis, and types of sampling media consistent with the purpose and scope of operational programs. Secretary of the Commission (SECY) 05-0197, “Review of Operational Programs in a Combined License Application and Generic Emergency Planning Inspections, Tests, Analyses, and Acceptance Criteria,” dated October 28, 2005, identifies the implementation of operational programs, including the elements identified in the

Radiological Effluent Technical Specifications (RETS)/Standard Radiological Effluent Controls (SREC), Offsite Dose Calculation Manual (ODCM), and Radiological Environmental Monitoring Program (REMP) in a DC or COL application.

I. Expected relationships and interpretation of results between monitoring instrumentation readouts, sample analytical results, and plant operations against radiological criteria, and administrative and regulatory limits.

J. Descriptions of procedures used for maintenance, periodic conduct of operational functional checks, and inspection of monitoring instrumentation and sampling systems.

K. Layout drawings, process piping and instrumentation diagrams (P&IDs), location of radiation or radioactivity monitoring instrumentation, locations of process and effluent sampling points and equipment, effluent flow diagrams, and locations and designations of effluent release or discharge points.

L. Monitoring systems and procedures used for the prevention and detection of radioactivity in nonradioactive systems to prevent unmonitored and uncontrolled releases of radioactive material to the environment.

M. Description of radiation monitoring equipment provided to comply with 10 CFR Part 50, Appendix E, "Emergency Planning and Preparedness for Production and Utilization Facilities," Section VI.2(a), which requires radiation monitoring systems for reactor coolant radioactivity, containment radiation level, condenser air removal radiation level and process radiation monitor levels.

3. The scope and elements of plant technical specifications (TS), RETs or SRECs as they relate to the plant's ODCM, REMP, and the Process Control Program (PCP, if included). The review evaluates the basis of limiting conditions for operations and controls for operation consistent with plant design features associated with the TS and RETS/SREC, as well as procedural details and programmatic controls of the ODCM and REMP.

4. The quality group and safety classifications of piping and equipment and the basis governing the classification chosen in accordance with the guidance of RG 1.143, "Design Guidance for Radioactive Waste Management Systems, Structures, and Components Installed in Light-Water-Cooled Nuclear Power Plants," design and expected temperatures and pressures and materials of construction of permanently installed systems and skid-mounted radiation monitoring and sampling equipment.

5. Design provisions incorporated in equipment and the facility to ease operation and maintenance in accordance with the guidance of RG 1.143, previous experience with similar equipment and methods, and information presented in topical reports.

6. Design features to reduce radioactivity levels in wastes, minimize, to the extent practicable, contamination of the facility and environment, facilitate eventual decommissioning; and minimize, to the extent practicable, the generation of radioactive waste using the guidance of RG 1.143 and RG 4.21, "Minimization of Contamination and Radioactive Waste Generation: Life-Cycle planning," and Nuclear Energy Institute

(NEI) 08-08A, “Generic FSAR Template Guidance for Life Cycle Minimization of Contamination,” Revision 0, October 2009.

7. For multi-unit stations, descriptions and design features of equipment and components (as permanently installed systems or in combination with skid-mounted radiation monitoring equipment) normally shared between interconnected processing and waste treatment systems and release points. Descriptions of system services (e.g., compressed air, water, vents and drains) interfaces whenever skid-mounted radiation monitoring systems are used to augment permanently installed equipment.

8. Definition of the boundary of the LWMS, GWMS, and SWMS beginning at the interface from plant systems provided for the collection of process streams and radioactive wastes to the point of controlled discharges to the environment as defined in the ODCM at the point of recycling to primary or secondary water system storage tanks in accordance with the guidance of RG 1.143.

9. Process used to develop, review, verify, validate, and audit digital computer software used in radiation monitoring and sampling equipment, including software used to terminate or divert process and effluent streams. This aspect addresses software developed by the applicant, purchased through a vendor, or included with the instrumentation.

10. Inspections, Tests, Analyses, and Acceptance Criteria (ITAAC). For DC and COL reviews, the staff reviews the applicant's proposed ITAAC associated with systems, structures, and components (SSCs) related to this SRP section using the guidance in SRP Section 14.3, “Inspections, Tests, Analyses, and Acceptance Criteria.” The staff recognizes that the review of ITAAC cannot be completed until after the rest of the related sections of the application have been reviewed against acceptance criteria contained in this SRP section. Furthermore, the staff reviews the ITAAC to ensure that all SSCs in this area of review are identified and addressed as appropriate under SRP Section 14.3 and using the guidance of RG 1.215, “Guidance for ITAAC Closure under 10 CFR Part 52.” Finally, under the requirements of SECY-05-0197, the implementation of operational programs, including the elements identified in the RETS/SREC, ODCM, REMP, and PCP do not necessitate ITAAC in a DC or COL application.

11. COL Action Items and Certification Requirements and Restrictions. For a DC application, the review addresses COL action items, requirements and restrictions (e.g., system interfaces and site parameters). For a COL application referencing a DC, a COL applicant must address COL action items (referred to as COL license information in certain DCs) included in the referenced DC. Additionally, a COL applicant must address requirements and restrictions (e.g., system interfaces and site parameters) included in the referenced DC, and note in instances where an applicant has submitted conceptual design information, given the requirements of 10 CFR 52.47(a)(24) through 10 CFR 52.47(a)(26), 10 CFR 52.79(d)(2), and 10 CFR 52.80(a).

12. For a COL application referencing a DC. For a COL, the applicant must address COL action items, requirements, and restrictions included in the referenced DC. The review should ensure that plant design features of the certified design are maintained in the COL application and that, if requested, the 10 CFR Part 52, “Licenses, Certifications,

and Approvals for Nuclear Power Plants," process for seeking exemptions, changes, and departures is observed in changing FSAR Tier 1, Tier 2, and Tier 2* information. Additionally, the review should confirm that the applicant has addressed the requirements and restrictions (e.g., system interfaces and site parameters) included in the referenced DC and how they are being incorporated under plant- and site-specific conditions.

13. ESP Application Reviews. This SRP section is not used to review an ESP application. For an ESP application, submitted under 10 CFR Part 52, Subpart A, "Early Site Permits," the review is limited to the information forming the basis of the radioactive liquid and gaseous effluent source terms, as defined by selected types of reactor technologies, and associated doses to members of the public.

14. Operational Program Description and Implementation. For OL and COL applications that include operational programs, the staff reviews the RETS/SREC, ODCM and REMP aspects of the PERMISS program description and the proposed implementation milestones for consistency with the generic operational programs described in SECY-05-0197 and inclusion in FSAR (Table 13.4-x) as license conditions. Alternatively, a COL applicant may use NEI ODCM Template 07-09A, "Generic FSAR Template Guidance for Offsite Dose Calculation Manual (ODCM) Program Description," (Revision 0, March 2009) for the purpose of meeting this regulatory milestone until a plant and site-specific operational program is made available before fuel load for NRC inspection, as described in the FSAR, Sections 13.4 and 13.5 of COL applications). The NEI ODCM Template 07-09A has been reviewed and found acceptable by the staff (Agencywide Documents Access and Management System (ADAMS) Accession No. ML083530745). The staff also reviews the applicable tables in the FSAR Section 13.4 (Table 13.4-x) to ensure that the RETS/SREC, ODCM, and REMP aspects of the process and effluent monitoring and sampling program and associated milestones are included as license conditions.

The review of the ODCM may be conducted as part of the review of SRP Section 11.4, "Solid Waste Management System," depending on whether the applicant has located the procedural details and programmatic controls in the PCP instead of the ODCM, given the provisions of Generic Letter (GL) 89-01, "Implementation of Programmatic Controls for Radiological Effluent Technical Specifications in the Administrative Controls Section of the Technical Specifications and the Relocation of Procedural Details of RETS to the Offsite Dose Calculation Manual or to the Process Control Program," dated January 31, 1989; NUREG-1301, "Offsite Dose Calculation Manual Guidance: Standard Radiological Effluent Controls for Pressurized-Water Reactors," for PWR plants or NUREG-1302, "Offsite Dose Calculation Manual Guidance: Standard Radiological Effluent Controls for Boiling-Water Reactors," for BWR plants and NUREG-0133, "Preparation of Radiological Effluent Technical Specifications for Nuclear Power Plants: A Guidance Manual for Users of Standard Technical Specifications," issued October 1987, for either type of reactor design.

When programmatic elements are used to assess design adequacy and effects on the development of new or modifications of existing operational programs, the reviewer confirms that the applicant has properly identified those elements of the program in DC and COL FSAR Section 13.4 (Table 13.4-x), as supplemental elements to an existing

program or as the addition of a new program. The staff's evaluation and conclusion of the acceptability of the augmented programmatic elements is addressed in Safety Evaluation Report (SER) Section 13.4, and relevant requirements and guidance identified in this SER section for the systems and components identified in the supplemental or new programmatic elements.

Review Interfaces

Systems described in the application may differ from those outlined in the SRP. The staff should use the following SRP section interfaces as the basis for reviewing supplemental or complementary information provided in the FSAR for a specific plant design. The reviewer of this SRP section should verify specific information, as needed to complete the evaluation, and coordinate this review with that of primary reviewers of the sections listed below.

1. The review of the PERMISS, in the context of instrumentation and controls required to actuate engineered safety feature (ESF) systems designed to prevent or mitigate consequences of accidents, which could result in offsite exposures comparable to the requirements of 10 CFR, Part 100, "Reactor Site Criteria," is performed under SRP Chapter 7, "Instrumentation and Controls," and SRP Section 13.3 (Emergency Planning), using RG 1.97 and BTP 7-10. For any portion of the PERMISS (accident monitoring systems) that supports safety-related functions, the review addresses the performance, design, qualification, display, QA, and selection of monitoring variables of radiation monitoring equipment required for accident monitoring and sampling.

2. The review of provisions used for sampling during accident conditions (via the post-accident sampling system) and in controlling sample leakage, spillage, and limiting radiation exposure to workers during sampling from process waste systems and effluent streams is conducted under SRP Section 9.3.2, "Process and Post-accident Sampling Systems"; SRP Section 12.3-12.4, "Radiation Protection Design Features"; and SRP Section 13.3, using the guidance of RG 1.21, "Measuring, Evaluating, and Reporting Radioactive Material in Liquid and Gaseous Effluents and Solid Waste"; RG 1.26, "Quality Group Classifications and Standards for Water-, Steam-, and Radioactive-Waste-Containing Components of Nuclear Power Plants"; RG 1.29, "Seismic Design Classification," RG 1.97 (for the identified accident monitoring variables), RG 1.143, and RG 4.21.

3. The review of design features of auxiliary systems and interfaces with radwaste management and monitoring systems is conducted under SRP Section 5.4.6, "Reactor Core Isolation Cooling System (BWR)"; SRP Section 5.4.8, "Reactor Water Cleanup System (BWR)"; SRP Section 5.4.13, "Isolation Condenser System (BWR)"; SRP Section 9.4.5, "Engineered Safety Feature Ventilation System"; SRP Section 9.1.3, "Spent Fuel Pool Cooling and Cleanup System"; SRP Section 9.3.1, "Compressed Air System"; SRP Section 9.3.3, "Equipment and Floor Drainage System"; and SRP Section 9.3.4, "Chemical and Volume Control System (PWR) (Including Boron Recovery System)." The review is conducted using the guidance of RG 1.26; RG 1.29; RG 1.52, "Design, Inspection, and Testing Criteria for Air Filtration and Adsorption Units of Post-Accident Engineered Safety-Feature Atmosphere Cleanup Systems in Light-Water Cooled Nuclear Power Plants"; RG 1.97, RG 1.140, "Design, Inspection, and Testing Criteria for Air Filtration and Adsorption Units of Normal Atmosphere Cleanup Systems

in Light-Water-Cooled Nuclear Power Plants"; RG 1.143; RG 4.21; and RG 8.8, "Information Relevant to Ensuring That Occupational Radiation Exposures at Nuclear Power Stations Will Be As Low As Is Reasonably Achievable," and RG 8.10, "Operating Philosophy for Maintaining Occupational Radiation Exposures As Low As Is Reasonably Achievable." Other systems may be considered in the review, as necessary, given specific design features.

4. For portions of the systems that may impact public health and safety under 10 CFR Part 20, the review of instrumentation and components, with respect to capability, reliability, and conformance to the acceptable criteria are reviewed using the guidance in SRP Section 7.1, "Instrumentation and Controls Introduction"; SRP Section 7.5, "Information Systems Important to Safety"; SRP Section 7.6, "Interlock Systems Important to Safety"; and SRP Section 7.7, "Control Systems"; and related BTPs in SRP Chapter 7, as mandated by design and operational considerations.

5. The review of TSs, as they relate to the RETS/SREC, ODCM, REMP, and PCP (if included in this section), is performed under SRP Chapter 16, "Technical Specifications"; TS Section 5.0; and SRP Sections 13.4, "Operational Programs"; and SRP Section 13.5. The associated TS are presented in NUREG-1430, "Standard Technical Specifications—Babcock and Wilcox Plants," issued April 2012; NUREG-1431, "Standard Technical Specifications—Westinghouse Plants," issued April 2012; NUREG-1432, "Standard Technical Specifications—Combustion Engineering Plants," issued April 2012; NUREG-1433, "Standard Technical Specifications—General Electric Plants (BWR/4)," issued April 2012; and NUREG-1434, "Standard Technical Specifications—General Electric Plants (BWR/6)," issued April 2012.

6. The organization responsible for QA performs the review of design, construction, and operation phase QA programs under SRP Chapter 17, "Quality Assurance," for any portion of the PERMISS that may be covered by 10 CFR Part 50, Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," requirements, depending on design features. The guidance of RG 1.143 applies to the balance of the PERMISS since it is not a safety-related system.

7. The review of the definition of the exclusion area boundary and administrative controls in managing liquid and gaseous effluent releases is performed using the guidance in SRP Section 2.1.2, "Exclusion Area Authority and Control"; SRP Section 11.2, "Liquid Waste Management System"; and SRP Section 11.3, "Gaseous Waste Management System."

8. The review of the placement of PERMISS monitoring and sampling equipment on GWMS discharge flow paths to the plant stack, and vents for other building exhaust ventilation systems depending on design features, is performed under SRP Sections 2.3 and 9.4.

9. The review of the basis of annual average atmospheric dispersion (X/Q) and deposition (D/Q) parameters, used in estimating doses from noble gases, radioiodines, carbon-14, tritium, and particulate effluents to members of the public in unrestricted areas, is conducted using the guidance in SRP Section 2.3.5, "Long-Term Atmospheric Dispersion Estimates for Routine Releases." The review addresses the design of the plant stack and building ventilation exhaust vents, as they relate to their site locations,

release heights, exhaust flow and velocity rates, and flow temperatures in assigning types of releases (e.g., as ground, mixed mode, or elevated releases).

10. The review of the basis of expected radiological source terms, as they relate to process and effluent streams monitored by the PERMISS, is conducted using the guidance in SRP Sections 11.2, 11.3, and 11.4, with the basis of the source terms provided in SRP Section 11.1, "Source Terms."

11. The review of the acceptability of the design analyses, procedures, and criteria used to establish the ability of seismic Category I structures housing the system and supporting systems to withstand the effects of natural phenomena, such as the safe-shutdown earthquake, the probable maximum flood, and tornadoes and tornado missiles, is performed using the guidance in SRP Section 3.3.1, "Wind Loadings"; SRP Section 3.3.2, "Tornado Loadings"; SRP Section 3.4.2, "Analysis procedures"; SRP Section 3.5.3, "Barrier Design Procedures"; SRP Section 3.7.1, "Seismic System Analysis" through SRP Section 3.7.4, "Seismic Instrumentation"; SRP Section 3.8.4, "Other Seismic Category I Structures"; and SRP Section 3.8.5, "Foundations."

12. The review of the acceptability of the seismic and quality group and safety classifications for structures and system components is performed under SRP Section 3.2.1, "Seismic Classification," and SRP Section 3.2.2, "System Quality Group Classification," using RG 1.143 design criteria and industry codes and standards. RG 1.143 provides guidance in assigning safety classifications to RWMS with PERMISS interfaces against natural phenomena and man-induced hazards is determining compliance with GDC 2, "Design Bases for Protection against Natural Phenomena."

13. The review of design features and instrumentation used for the protection of potable and sanitary water systems is conducted under SRP Section 9.2 using the guidance in RG 4.21. Other systems may include demineralized water makeup system, condensate storage facilities, safety-chilled water systems, component cooling water system, an essential service water system, turbine cooling water system, and the seal water supply system.

14. The review of design features and instrumentation used for the leakage detection systems, including appropriate radiation monitoring systems, is conducted under SRP Section 12.3-12.4; and SRP Section 5.2.5, "Reactor Coolant Pressure Boundary Leakage Detection"; and BTP 5-1, "Monitoring of Secondary Side Water Chemistry in PWR Steam Generators," as they relate to detection sensitivities and types of detectors specified for radiation monitors used in complying with NEI 97-06, "Steam Generator Program Guidelines," Revision 3, issued January 2011; underlying Electric Power Research Institute (EPRI) Guidelines, and guidance of RG 1.29 and RG 1.45, "Guidance of Monitoring and Responding to Reactor Coolant System Leakage"; and Regulatory Issue Summary (RIS) 2009-02, "Use of Containment Atmosphere Gaseous Radioactivity Monitors as Reactor Coolant System Leakage Detection Equipment at Nuclear Power Reactors," Revision 1, issued, May 8, 2009; and Information Notice (IN) 2005-24, "Nonconservatism in Leakage Detection Sensitivity," dated August 3, 2005. (Revision 1).

15. The review of design features of steam and power conversion systems and interfaces with radwaste management and monitoring systems is conducted under SRP Section 10.4, and SRP Section 5.4.2 using the guidance of RG 1.26, RG 1.29, and RG 1.143. The systems may include the main condenser evacuation system, turbine gland sealing system, condensate cleanup system, steam generator blowdown system, secondary-steam system chemistry, steam generator blowdown treatment system, circulating water system, turbine component cooling water system, and turbine floor drains.

16. The review of design features of plant and building ventilation systems and interfaces with radwaste management and monitoring systems is conducted under SRP Section 9.4 and SRP Chapter 6 using the guidance of RG 1.13, "Spent Fuel Storage Facility Design Basis"; RG 1.29; RG 1.52; RG 1.140; and RG 1.143. The systems include the reactor containment building ventilation and treatment systems, spent-fuel pool area ventilation system, isolation condenser exhaust, auxiliary and radwaste buildings and area ventilation systems, turbine building and area ventilation system, and ESF ventilation systems.

17. The review of the fire protection program and interfaces with building ventilation systems, and radiation monitoring equipment in detecting the presence of radioactivity, given the use or presence of flammable or combustible materials (as spent resins, charcoal media, and high efficiency particulate air filters, and dry wastes), is performed under SRP Section 9.5.1, "Fire Protection Program," and SRP Section 11.4, using the guidance of RG 1.189, "Fire Protection for Nuclear Power Plants."

18. The review of the ALARA provisions of RGs 8.8 and 8.10 in system design and operation to assure compliance with the occupational dose limits of 10 CFR 20.1201, "Occupational Dose Limits"; and 10 CFR 20.1202, "Compliance with Requirements for Summation of External and Internal Doses"; and Table 1, of Appendix B, "Annual Limits on Intake (ALIs) and Derived Air Concentrations (DACs) of Radionuclides for Occupational Exposure; Effluent Concentrations; Concentrations; for Release to Sewerage," to 10 CFR Part 20, and 10 CFR 20.1501, "General," is conducted under SRP Chapter 12, "Radiation Protection."

19. The review of design features to reduce radioactivity levels in wastes; minimize, to the extent practicable, contamination of the facility and environment; facilitate eventual decommissioning; and minimize, to the extent practicable, the generation of radioactive waste is performed under SRP Section 12.3-12.4, "Radiation Protection Design Features," using the guidance of RG 1.143 and RG 4.21 and NEI 08-08A in complying with the requirements of 10 CFR 20.1406, "Minimization of Contamination."

20. For OL and COL reviews of operational programs, the review of the applicant's implementation plan is performed using the guidance in SRP Sections 13.4 and 13.5.,

21. The review of design features of PERMISS systems and components associated with the plant's initial testing plan, description of tests, and testing acceptance criteria is performed under SRP Section 9.3.2, and SRP Section 14.2, "Initial Plant Test Program – Design Certification and New License Applicants," using the guidance of RG 1.68, "Initial Test Programs for Water-Cooled Nuclear Power Plants."

22. The completeness of the description of the PERMISS design and its operational features are reviewed using the guidance in SRP Section 14.3.7, “Plant Systems – Inspections Tests, Analyses, and Acceptance Criteria,” to ensure that they are technically complete for their inclusion in Tier 1, Tier 2, and Tier 2* ITAAC and include sufficient information in confirming that ITAAC are inspectable, with compliance being demonstrated with no ambiguity.

23. The review of TS, as they relate to allowable reactor coolant system (RCS) leakage rate, radiation instrumentation and sampling equipment used in monitoring allowable RCS leakage rates, primary-to-secondary steam generator tube leakage rates, and steam generator tube integrity, are reviewed under SRP Chapter 16, based on plant-specific TS information using NRC and industry guidance. The associated TS are presented in NUREG-1430, NUREG-1431, NUREG-1432, NUREG-1433, and NUREG-1434.

24. The review of QA provisions for radiation monitoring and sampling equipment is performed under SRP Section 17.1, “Quality Assurance During the Design and Construction Phases,” and SRP Section 17.5, “Quality Assurance Program Description – Design Certification, Early Site Permit and New License Applicants,” using the guidance of RG 1.143 for liquids and liquid streams and waste media produced during normal operation and AOOs, and using NRC and industry guidance.

25. The review of compliance with 10 CFR 50.65(a) and 10 CFR 50.65(b), is conducted under in SRP Section 12.3-12.4; SRP Section 12.5, “Operational Radiation Protection Program”; and SRP Section 13.4, Table 13.4-x, Item 17, using the guidance of RG 1.160, “Monitoring the Effectiveness of Maintenance at Nuclear Power Plants,” as it relates to radiation monitoring instrumentation used to control and monitor effluent releases and mitigate effluent discharges during AOOs and accidents..

II. ACCEPTANCE CRITERIA

Requirements

Acceptance criteria are based on meeting the relevant requirements of the following Commission regulations:

1. 10 CFR 20.1101(b), as it relates to the use of procedures and engineering controls in maintaining releases of radioactivity and doses to members of the public ALARA.

2. 10 CFR 20.1302, “Compliance with Dose Limits for Individual Members of the Public,” and 10 CFR 20.1301(e), as they relate to the monitoring of radioactivity in plant radiological effluents to unrestricted areas. These criteria apply to all effluent releases resulting from operation during normal plant operations and AOOs.

3. 10 CFR 20.1406, as it relates to the design and operational procedures in minimizing contamination, facilitating eventual decommissioning, and minimizing the generation of radioactive waste.

4. 10 CFR 20.1501, as it relates to the conduct of radiation surveys in monitoring the presence of radioactivity in RWMS and in process and effluent streams.

5. 10 CFR 50.34a, “Design Objectives for Equipment to Control Releases of Radioactive Material in Effluents—Nuclear Power Plants,” as it relates to equipment design and procedures used to control releases of radioactive material to the environment within the numerical guidance provided in Appendix I, “Numerical Guides for Design Objectives and Limiting Conditions for Operation to Meet the Criterion ‘As Low As Is Reasonably Achievable’ for Radioactive Material in Light-Water-Cooled Nuclear Power Reactor Effluents,” to 10 CFR Part 50.

6. 10 CFR 50.34(f), as it relates to additional TMI-related requirements and TMI Action Plan Items and Generic Safety Issues identified in NUREG-0933, “Resolution of Generic Safety Issues” (Formerly entitled “A Prioritization of Generic Safety Issues”).

7. Requirements specified in 10 CFR 50.34(f)(2)(viii), 10 CFR 50.34(f)(2)(xiv)(E), 10 CFR 50.34(f)(2)(xvii), 10 CFR 50.34(f)(2)(xxvi), and 10 CFR 50.34(f)(2)(xxvii) for monitoring gaseous effluents from all potential accident release points, consistent with the requirements of GDC 63, “Monitoring Fuel and Waste Storage,” and GDC 64 in minimizing exposures to members of the public. For 10 CFR Part 50 applicants not listed in 10 CFR 50.34(f)(2), the applicable provisions of 10 CFR 50.34(f)(2) will be made a requirement during the licensing process and added as a license condition, as warranted.

8. 10 CFR 50.36a, “Technical Specifications on Effluents from Nuclear Power Reactors,” as it relates to operating procedures and equipment installed in the radioactive waste system pursuant to 10 CFR 50.34a to ensure that releases of radioactive materials to unrestricted areas are kept ALARA.

9. 10 CFR 50.59, “Changes, Tests, and Experiments,” implemented using the guidance in RG 1.187, “Guidance for Implementation of 10 CFR 50.59, Changes, Tests, and Experiments,” as it relates to design changes and differences in monitoring performance characteristics of PERMISS components in demonstrating compliance with effluent concentration limits of 10 CFR Part 20, Appendix B, Table 2.

10. 10 CFR 50.65(a) and 10 CFR 50.65(b) as they relate to providing reasonable assurance that SSCs important to safety, including those that are relied upon to mitigate accidents or transients or are used in plant emergency operating procedures (i.e., radiation monitors described in this SRP, or radiation protection features described in SRP Sections 12.3-12.4 and 12.5) are capable of fulfilling their intended functions.

11. 10 CFR Part 50, Appendix A, GDC 2 as it relates to the design basis of structures housing RWMS and its components using the guidance of RG 1.143 in assigning seismic, safety, and quality group classifications for natural phenomena and man-induced hazards as defined in RG 1.143 in assigning safety classifications to RWMS with PERMISS interfaces.

12. 10 CFR Part 50, Appendix A, GDC 19, “Control Room,” as it relates to actuation of systems that permit access and occupancy of the control room under accident conditions without personnel receiving radiation exposures in excess of 5-rem total effective dose equivalent for the duration of the accident.

13. 10 CFR Part 50, Appendix A, GDC 60 and GDC 61, “Fuel Storage and Handling and Radioactivity Control,” as they relate to controlling effluent releases from the LWMS, GWMS, and SWMS and designing these systems to handle radioactive materials produced during normal plant operation, AOOs, and postulated accidents.

14. 10 CFR Part 50, Appendix A, GDC 63 and GDC 64, as they relate to designing the LWMS, GWMS, and SWMS to monitor radiation levels and radioactivity in effluents, as well as radioactive leakages and spills, during routine operation and AOOs.

15. 10 CFR Part 50, Appendix B, Sections XI and XII, as they relate to programs and procedures for the control of measuring and test equipment as it applies to radiation monitoring and sampling instrumentation for systems not covered by the QA guidance of RG 1.143

16. 10 CFR Part 50, Appendix I, as it relates to numerical guides for design objectives to meet the requirements of 10 CFR 50.34a and 10 CFR 50.36a, which specify that radioactive effluents released to unrestricted areas will be kept ALARA.

17. 10 CFR 52.47(b)(1), which requires that a DC application contain the proposed ITAAC that are necessary and sufficient to provide reasonable assurance that, if the inspections, tests, and analyses are performed and the acceptance criteria are met, a facility that incorporates the DC has been constructed and will be operated in conformity with the DC, the provisions of the Atomic Energy Act (AEA), and the NRC regulations.

18. 10 CFR 52.80(a), which requires that a COL application contain the proposed inspections, tests, and analyses, including those applicable to emergency planning, that the licensee shall perform, and the acceptance criteria that are necessary and sufficient to provide reasonable assurance that, if the inspections, tests, and analyses are performed and the acceptance criteria met, the facility has been constructed and will operate in conformity with the COL, the provisions of the AEA, and the NRC regulations.

19. 40 CFR Part 190, “Environmental Radiation Protection Standards for Nuclear Power Operations” (U.S. Environmental Protection Agency (EPA) generally applicable environmental radiation standards) for nuclear power operations, as implemented under 10 CFR 20.1301(e), as it relates to limits on total annual doses from all sources of radioactivity contained in liquid and gaseous effluent discharges and external radiation from site buildings and facilities (with single or multiple reactor units). SRP Sections 11.2, 11.3, and 11.4, evaluate source terms and doses from liquid effluents and solid wastes. This SRP addresses the means to demonstrate compliance with all sources of effluents. SRP Section 12.3-12.4, evaluates doses associated with external radiation from buildings and sources of radioactivity contained in systems and components, including skyshine from BWR turbine buildings.

SRP Acceptance Criteria

Specific SRP acceptance criteria acceptable to meet the relevant requirements of the NRC regulations identified above are set forth below. The SRP is not a substitute for the NRC regulations, and compliance with it is not required. However, an applicant is required to identify differences between this SRP section and design features, analytical techniques, and procedural measures proposed for the facility, and discuss how the proposed alternatives to the

SRP acceptance criteria provide acceptable methods of complying with regulations that underlie SRP acceptance criteria and meeting NRC regulatory requirements under 10 CFR 50.34(h), 10 CFR 52.17(a)(1)(xii), 10 CFR 52.47(a)(9) and 10 CFR 52.79(a)(41) for ESP, CP, DC, OL and COL applications.

1. Provisions should be made for the installation of instrumentation and monitoring equipment and sampling and analyses of all normal and potential effluent release paths of radioactive materials to the environment, including nonradioactive systems that could become radioactive through interfaces with radioactive systems. For GDC 64 and the requirements specified in 10 CFR 50.34(f)(2)(viii), 10 CFR 50.34(f)(2)(xiv)(E), 10 CFR 50.34(f)(2)(xvii), 10 CFR 50.34(f)(2)(xxvi), and 10 CFR 50.34(f)(2)(xxvii), the system designs should meet the provisions of RG 1.21 (Position C and Appendix A), and Appendix A, to RG 1.33, "Quality Assurance Program Requirements (Operation)." SRP Chapter 7 provides additional guidance on the application of RG 1.97 and BTP 7-10 for any portion of the PERMISS (accident monitoring systems) that supports safety-related functions or used to comply with 10 CFR Part 20 regulations, as identified by the applicant.

   A. The gaseous and liquid process streams or effluent release points should be monitored and sampled according to Tables 1 and 2 of this SRP. Other process monitoring and sampling systems may be added beyond those listed in either table, if not presented elsewhere in the application. Among others, such radiation monitoring systems may include those used on main steam lines, for RCS leakage detection in containment atmospheres, in control room air intakes, or those used for accident monitoring and sampling.

   B. Liquid waste and gaseous waste (contained in tanks) should be sampled on a batch basis before their release using the guidance of RG 1.21. Open structures, such as turbine buildings or atmospheric vents for liquid waste tanks containing treated or processed liquid waste and located outside of buildings, do not require continuous gaseous effluent monitors but the potential for releases and estimates of such releases should be evaluated and documented by other means. For liquid and gaseous effluents that cannot be easily monitored or sampled on a batch basis, one of the following representative sampling methods should be provided:

      i. Use of a continuous proportioning sampling system, with at least two sample collection tanks. The system should be designed to collect a sample at a fixed ratio established between the sample collection flow rate and the effluent stream discharge flow rate.

      ii. Use of a periodic automatic grab sampling system, with at least two sample collection tanks. The system should be designed to collect a sample at a fixed volume established at a rate that is proportional to the effluent stream discharge flow rate.

      For radioactive materials, other than noble gases in gaseous effluents, a continuous sampling system should be used with replaceable particulate filters (fixed or moving) and radioiodine absorber cartridges. The system

should be designed to automatically take representative samples, with minimal and quantifiable line or deposition losses, at a known flow rate established in accordance with American National Standards Institute (ANSI)/Health Physics Society (HPS) N13.1-2011, "Sampling and Monitoring Releases of Airborne Radioactive Substances from the Stacks and Ducts of Nuclear Facilities," approved March 30, 2011.

iii. For intermittently operating effluent release points, the system should be designed to automatically take samples whenever effluents are flowing in the discharge stream using a known ratio between discharges and sampling stream flow rates.

iv. Periodic sampling and analysis frequencies and types of radiological analyses should be specified for all samples described above in the RETS/SREC and ODCM.

2. Provisions should be made for the installation of instrumentation and monitoring equipment and periodic or continuous sampling and analysis of radioactive waste process systems. For GDC 60 and GDC 63, as they relate to RWMS, detection of excessive radiation levels and initiation of appropriate safety actions, the design of systems should meet the guidance of Appendix 11.5-A to this SRP section, RG 1.21 (Position C, as applicable), RG 4.15, "Quality Assurance for Radiological Monitoring Programs (Inception through Normal Operations to License Termination)—Effluent Streams and the Environment," (Position C); and Appendix A to RG 1.33. SRP Chapter 7 and BTP 7-10 provide additional guidance on the application of RG 1.97 for any portion of the PERMISS (accident monitoring systems) that supports safety-related functions, as identified by the applicant.

A. Provisions should be made to ensure representative sampling from radioactive process streams and tank contents. Recirculation pumps for liquid waste tanks (collection or sample tanks) should be capable of recirculating at a rate of not less than two-tank volumes in 8 hours. For gaseous and liquid process stream samples, provisions should be made for purging sampling lines and for reducing the plate-out of radioactive materials in sample lines. Provisions for gaseous sampling from ducts and stacks should be consistent with ANSI/HPS N13.1-2011. For airborne radiation monitoring systems that rely on moving filters, the applicant should describe their intended use (e.g., for qualitative vs. quantitative evaluations of airborne radioactivity levels), calibration methods, and response time until full activity equilibrium is achieved as a function of filter paper travel rate under the radiation detector.

B. When practicable, provisions should be made to collect samples from process waste streams at central sampling stations to reduce leakage, spillage, and radiation exposures to operating personnel using the guidance of SRP Section 9.3.2 in identifying systems and sampling locations and compliance with 10 CFR 20.1406 using the guidance of RG 4.21 and SRP Section 12.3-12.4.

C. Provisions should be made to purge and drain sample streams back to the system of origin or to an appropriate waste treatment system (e.g., LWMS and

GWMS). Purge lines should be equipped with provisions that prevent backflows and cross-contamination of nonradioactive systems supplying purging and flushing fluids (e.g., clean water, air, inert gases). The source of nonradioactive purging or flushing fluid should be protected using appropriate measures, such as check valves, backflow preventers, interlocks, differential pressures, etc. Contaminated purged fluids should be returned to the most appropriate RWMS for processing.

3. Provisions should be made for administrative and procedural controls for the installation of auxiliary or ancillary equipment, inclusions of special features in instrumentation and radiological monitoring sampling systems, and for the analysis of process and effluent streams. In complying with GDC 63 and GDC 64 requirements (including the requirements specified in 10 CFR 50.34(f)(2)), as they relate to radioactive waste process systems and effluent discharge paths, the design of systems and the implementation of administrative and procedural controls should be consistent with the guidance of Appendix 11.5-A to this SRP section, RG 1.21 (Position C), RG 4.15 (Position C), and Appendix A to RG 1.33. SRP Chapter 7 and BTP 7-10 provide additional guidance on the application of RG 1.97 for any portion of the PERMISS (accident monitoring systems) that supports safety-related functions, as identified by the applicant. The full provisions of 10 CFR 50.34(f)(2) include 10 CFR 50.34(f)(2)(viii), 10 CFR 50.34(f)(2)(xiv)(E), 10 CFR 50.34(f)(2)(xvii), 10 CFR 50.34(f)(2)(xxvi), and 10 CFR 50.34(f)(2)(xxvii)).

   Instrumentation, sampling, and monitoring provisions should conform to the following:

   A. Sampling frequencies, required analyses, instrument alarm/trip setpoints, calibration and sensitivities, and provisions for preparing composite samples for radioactivity analyses should implement the guidance of RGs 1.21, RG 1.33, and RG 4.15. The plant's RETS/SREC and ODCM should indicate sampling frequencies and required analyses.

   B. Provisions should be made for the necessary instrumentation and facilities to perform gross beta-gamma and gross alpha measurements, isotopic or radionuclide-specific analyses, and other routine analyses using the guidance of RG 1.21, RG 1.33, and RG 4.15.

   C. Provisions should be made to perform routine instrument calibration, maintenance, and inspections using the guidance of RG 4.15 and RG 1.33. Instrumentation calibration procedures should consider whether instrumentation response is expected to change given that radionuclide distributions may vary with the operating status of the plant (i.e., normal operation, AOOs, accidents, and post- accident conditions). The plant's RETS/SREC and ODCM should indicate the frequency of calibration and maintenance cycles. Provisions should also be made to replace or decontaminate instrumentation or sampling equipment without opening the process system or losing the capability of isolating the effluent stream.

   D. Isolation valves and dampers with automatic control features should fail in the closed or safe position to prevent unmonitored and uncontrolled releases of

radioactivity. The plant's RETS/SREC and ODCM should establish setpoints for the actuation of automatic control features in initiating the timely actuation of valves and dampers in isolating or diverting flows. The basis for establishing instrumentation alarm or system activation setpoints should be provided, taking into consideration the following:

i. For liquid effluents, in-plant effluent dilution factors and dilution factors beyond the point of discharge to the site boundary and nearest offsite dose receptors.

ii. For gaseous and particulate effluents from plant stacks and building vents, atmospheric dispersion (X/Q) and deposition (D/Q) factors to the site boundary and offsite dose receptors.

iii. The review of the design of the plant stack and building ventilation exhaust vents, as they relate to their site locations, release heights, exhaust flow and velocity rates, and exit temperatures in determining the type of release for each release point, using the guidance of SRP Section 2.3.

E. Non-engineered safety feature instrumentation provisions for automatic termination or diversion of releases should conform to the design guidance contained in Appendix 11.5-A to this SRP section. RG 1.97, SRP Chapter 7 (with BTP 7-10), and SRP Section 13.3 provide guidance on the review the ESF instrumentation and provisions for automatic termination of releases, as they relate to types and ranges of monitoring variables and qualification of radiation monitoring equipment required for accident monitoring.

F. The process used to develop, review, verify, validate, and audit digital computer software used in radiation monitoring and sampling equipment, including software used to terminate or divert process and effluent streams should be described by the applicant. This aspect includes software developed by the applicant, purchased through a vendor, or included with the instrumentation.

4. Provisions should be made for monitoring instrumentation, sampling, and sample analyses for all identified gaseous effluent release paths in the event of a postulated accident. For GDC 64, as it relates to potential gaseous effluent release paths, the design of systems should be consistent with the provisions of NUREG-0718, "Licensing Requirements for Pending Applications for Construction Permits and Manufacturing Licenses," issued June 1981; NUREG-0933; and NUREG-0737, "Clarification of TMI Action Plan Requirements," issued November 1980; Item II.F.1 and Attachments 1 and 2; 10 CFR 50.34(f)(2)(viii); 10 CFR 50.34(f)(2)(xiv)(E); 10 CFR 50.34(f)(2)(xvii); 10 CFR 50.34(f)(2)(xxvi); and 10 CFR 50.34(f)(2)(xxvii), Appendix 11.5-A to this SRP section, and RG 1.97. SRP Chapter 7 and BTP 7-10 provide additional guidance on the application of RG 1.97. For any portion of the PERMISS (accident monitoring systems) that supports safety-related functions, the review addresses the performance, design, qualification, display, QA, and selection of monitoring variables of radiation monitoring equipment required for accident monitoring and sampling. In addition, the design of the

gaseous waste collection and processing system should meet the guidance of SRP Sections 9.3.2, 11.3, and 13.3, as well as the following conditions:

A. Administrative controls and procedures should be consistent with Acceptance Criterion 3 (above) of this SRP section in minimizing inadvertent or accidental releases of radioactive gaseous and particulate effluents.

B. Gaseous and particulate radiological effluent monitors should be provided for the automatic termination of releases in the event that effluent release setpoints are exceeded, as described in Acceptance Criterion 1 (above) of this SRP section, and implemented in the plant's RETS/SREC and ODCM.

C. When two or more radiation monitoring systems are used for accident monitoring on a single discharge point, differences in instrumentation response characteristics should be described over their overlapping operational ranges for expected concentrations of noble gases, particulates, and halogens.

5. Provisions should be made for monitoring instrumentation, sampling, and sample analysis for all identified liquid effluent release paths in the event of a postulated accident. These provisions should be in accordance with GDC 64 and the requirements of 10 CFR 50.34(f)(2)(viii), 10 CFR 50.34(f)(2)(xiv)(E), 10 CFR 50.34(f)(2)(xvii), 10 CFR 50.34(f)(2)(xxvi), and 10 CFR 50.34(f)(2)(xxvii), as they relate to postulated accidents and identified liquid effluent release paths. In addition, the design of the liquid waste collection and processing system should meet the guidance of SRP Sections 9.3.2, 11.2, and 13.3, as well as the following conditions:

A. Administrative controls and procedures should be consistent with Acceptance Criteria 2 and 3 (above) of this SRP section in minimizing inadvertent or accidental releases of radioactive liquids.

B. Liquid effluent radiological monitors should be provided for the automatic termination of releases in the event that effluent release setpoints are exceeded, as described in Acceptance Criterion 1 (above) of this SRP section, and implemented in the plant's RETS/SREC and ODCM.

C. When two or more radiation monitoring systems are used for accident monitoring on a single discharge point, differences in instrumentation response characteristics should be described over their overlapping operational ranges for expected radionuclide distributions and concentrations.

6. The requirements specified in 10 CFR 50.34(f)(2)(viii), 10 CFR 50.34(f)(2)(xiv)(E), 10 CFR 50.34(f)(2)(xvii), 10 CFR 50.34(f)(2)(xxvi), and 10 CFR 50.34(f)(2)(xxvii) include provisions for monitoring gaseous effluents from all potential accident release points.

In examining the applicant's system for sampling process streams and effluents under accident conditions, the reviewer considers RG 1.97 and RG 1.101, "Emergency Planning and Preparedness for Nuclear Power Reactors"; SRP Chapter 7; and BTP 7-10; NUREG-0933; NUREG-0737, Item II.B.3 (Clarification Items 1, 3, 6, and 11); Item II.E.4.2 (Clarification Items 2, 5, and 7 and Attachment 1); Item II.F.1, Attachment 1 on noble gas effluent monitors; Item III.D.1.1 (Clarification Items 1 and 3); Item III.D.3.3

(Clarification Items 1 to 4); and letter from D.G. Eisenhut, dated August 16, 1982. Using the guidance of SRP Sections 9.3.2 and 13.3, the applicant's should address these aspects in the emergency plan and implementing procedures. For any portion of the PERMISS accident monitoring systems that supports safety-related functions, as identified by the applicant, the review of these design features is performed under SRP Chapter 7 using the guidance of RG 1.97 and BTP 7-10. The review, using RG 1.97 and RG 1.151, "Instrument Sensing Lines," addresses the performance, design, qualification, display, QA, and selection of monitoring variables of radiation monitoring equipment required for accident monitoring and sampling. The principal functional capabilities should:

A. Include purging lines to flush sampling lines and return purging fluids to the appropriate systems for collection or treatment.

B. Include design features that minimize sample losses by reducing the length and bending radii of sample lines in ensuring that samples are representative of reactor primary coolant, reactor steam, secondary coolant, and process steam.

C. Maximize sample quality and integrity by reducing conditions that would distort a sample's chemical and physical compositions.

D. Prevent blockage of sample lines by foreign matters or dual phase flows.

E. Minimize sampling flow restrictions and using remotely operated isolation valves to limit reactor coolant loss from ruptured sample lines.

F. Use sampling lines that are as short as practicable in minimizing the volume of process fluid taken from containment process, system processes, and effluent streams.

G. For inline radiation monitoring, design should provide backup provisions for grab sampling under an expected range of radiological conditions and provide the means to protect personnel from excessive radiation levels and airborne concentrations at sampling stations.

H. Verify that specifically identified radioactive release points have provisions for automatic termination or rerouting of releases when exceeding predetermined alarm levels.

I. Confirm that the design allows detectors to be replaced or decontaminated without opening the boundary of the process system or without losing the capability of isolating the system or diverting effluents to tanks or standby treatment systems (as appropriate).

J. When two or more radiation monitoring systems are used for accident monitoring on a single discharge point or process stream, confirm that differences in instrumentation response characteristics are described over their expected overlapping operational ranges for noble gases, particulates, and radioiodines.

K. Confirm that proposed instrumentation calibration methods consider whether instrumentation responses are expected to change given that radionuclide distributions may vary with the operating status of the plant, such as during normal operation, AOOs, and accident and post-accident conditions.

If the provisions do not address post-accident sampling, the reviewer should refer instead to the "Notice of Availability for Referencing in License Amendment Applications Model Safety Evaluation on Technical Specification Improvement to Eliminate Requirements on Post-Accident Sampling Systems using the Consolidated Line Item Improvement Process." Under this notice, the applicant should address the following:

A. Describe contingency plans for obtaining and analyzing highly radioactive samples of reactor coolant, containment sump, and containment atmosphere.

B. Describe the capability for classifying fuel damage events at the Alert Level threshold (typically at the 300 microcuries per milliliter (μCi/mL) iodine-131 dose equivalent, or about 11.1 MBq/mL).

C. Describe the capability to monitor radioiodines that have been released to offsite environs.

7. Operational Programs. For OL and COL reviews, the description of the operational program and proposed implementation milestone for the RETS/SREC, ODCM and REMP (and PCP if included) are reviewed in accordance with 10 CFR 20.1301, "Dose Limits for Individual Members of the Public"; and 10 CFR 20.1302; 10 CFR 50.34a; 10 CFR 50.36a; and 10 CFR Part 50, Appendix I, Sections II and IV. Their implementation is required by a license condition.

   If applicable, the staff reviews the proposed augmentation of programmatic elements in assessing the adequacy of the PERMISS design and resulting effects on the development of the RETS/SREC, ODCM, and REMP. When programmatic elements are used to assess design adequacy and effects on the development of new or modifications of existing operational programs, the reviewer confirms that the applicant has properly identified those elements of the program in DC and COL FSAR Section 13.4 (Table 13.4-x), as supplemental elements to an existing program or as the addition of a new program.

8. Descriptions of design features and instrumentation used in primary and secondary coolant system leakage detection systems should be consistent with NEI 97-06 and underlying EPRI Guidelines, and guidance of RG 1.29 and RG 1.45. Additional guidance is given in RIS 2009-02 (Revision 1) and IN 2005-24, as they relate to detection sensitivities and types of detection methods used in demonstrating conformance with SRP Chapter 16 and TS 16.3.4. The associated TS are presented in NUREG-1430, NUREG-1431, NUREG-1432, NUREG-1433, and NUREG-1434.

Technical Rationale

The technical rationale for application of these acceptance criteria to the areas of review addressed by this SRP section is discussed in the following paragraphs:

1. 10 CFR 20.1302 specifies, in part, that licensees conduct surveys of radiation levels in unrestricted and controlled areas and sample and analyze radioactive materials in effluents released to unrestricted and controlled areas to demonstrate compliance with dose limits for members of the public in 10 CFR 20.1301.

   10 CFR 20.1302 relates to the manner in which compliance with dose limits to individual members of the public will be achieved. This section specifies that surveys of radiation levels are conducted to demonstrate compliance with the dose limits specified in 10 CFR 20.1301. In addition, 10 CFR 20.1501 requires that surveys be conducted to demonstrate compliance with the regulations of 10 CFR Part 20. These surveys use the equipment that constitutes the process and effluent radiological monitoring instrumentation and sampling systems. RG 1.21, RG 1.33, RG 1.151, and RG 4.15, as well as industry standards (i.e., ANSI N42.18-2004, "Specification and Performance of On-Site Instrumentation for Continuously Monitoring Radioactivity in Effluents," issued 2004, and ANSI/HPS N13.1-2011) provide additional guidance on measuring, evaluating, and reporting the results of radiological surveys.

   Meeting the above noted NRC and industry guidance provides reasonable assurance that the dose limits to individual members of the public specified in 10 CFR 20.1301 and 10 CFR 20.1301(e) will not be exceeded, including those of the EPA standards in 40 CFR Part 190. The review, conducted in this SRP section, with supporting information drawn from SRP Sections 11.2, 11.3, and 11.4, evaluates the method used to demonstrate compliance with these requirements using NRC and industry guidance in developing operational programs.

2. 10 CFR 50.34a specifies that an application to construct or operate a nuclear power plant describe the design of equipment installed to maintain control of radioactive materials in plant effluents produced during normal operation and AOOs.

   10 CFR 50.34a relates to this SRP section because processes to monitor and survey radioactive materials in liquid and gaseous effluent streams released to the environment provide information in establishing controls over these effluents. As described in this SRP section, 10 CFR 50.34a specifies the equipment used to monitor and evaluate effluent releases.

   The review conducted in this SRP section, with supporting information from SRP Sections 11.2, 11.3, 1.151 and 11.4, evaluates the method used to demonstrated compliance with these requirements using NRC and industry guidance in developing operational programs.

   Meeting the above noted guidance provides reasonable assurance that requirements of 10 CFR 50.34a will be met and that the levels of radioactivity in effluents will meet the ALARA criterion and design objectives of Appendix I to 10 CFR Part 50.

   RG 1.143 provides guidance in assigning safety classifications to structures and RWMS in protecting SSCs against natural phenomena and man-induced hazards, including system interfaces with the PERMISS. Conformance with this guidance is addressed separately in SRP Section 11.2 for the LWMS, SRP Section 11.3 for the GWMS and Section 11.4 for the SWMS.

3. 10 CFR 50.36a specifies, in part, that licenses for nuclear power reactors will include TS requiring that operating procedures be developed for the equipment specified in this regulation.

   In accordance with 10 CFR 50.36a, licensees must include TS (RETS/SREC) as part of the operating procedures related to radiological monitoring and sampling equipment and as part of the requirements for administrative controls and surveillance. The ODCM consolidate the plant's TS and related radiological effluent controls, as stated in GL 89-01. NUREG-1301 or NUREG-1302, NUREG-0133, and NUREG-0543, "Methods for Demonstrating LWR Compliance with the EPA Uranium Fuel Cycle Standard (40 CFR Part 190)," issued February 1980, present the format and content of an ODCM that applicant should use for LWR. The review conducted in this SRP section, with supporting information from SRP Sections 11.2, 11.3, and 11.4, evaluates the methods and results used to demonstrate compliance with these requirements using NRC and industry guidance in developing operational programs.

   Meeting the above noted guidance provides reasonable assurance that the requirements of 10 CFR 50.36a will be met and that the levels of radioactivity in effluents will meet the ALARA criterion of 10 CFR Part 50, Appendix I and comply with dose limits to members of the public under 10 CFR 20.1301.

4. Appendix I to 10 CFR Part 50 provides numerical guides for the ALARA criterion for radioactive materials released by light-water-cooled nuclear power reactors. 10 CFR 50.34a and 10 CFR 50.36a contain provisions designed to ensure that releases of radioactive materials, as liquid and gaseous effluents, from nuclear power reactors to unrestricted areas during normal operation, including AOOs, are ALARA. 10 CFR Part 50, Appendix I provides specific numerical criteria and guidance for meeting this requirement. The review conducted in this SRP section, with supporting information from SRP Sections 11.2, 11.3, and 11.4, evaluates the methods and results used to demonstrate compliance with these requirements using NRC and industry guidance in developing operational programs.

   Meeting the above noted guidance provides reasonable assurance that the ALARA criterion will be met and that offsite doses to any individual from normal operations and AOOs will not result in exposures in excess of the numerical guides specified in Section II of Appendix I to 10 CFR Part 50.

5. Compliance with GDC 60 requires that the nuclear power plant design include mechanisms to control the release of radioactive materials in gaseous and liquid effluents and to handle radioactive solid wastes produced during normal reactor operation and AOOs.

   The guidance of SRP Section 11.5 applies to GDC 60 because mechanisms to control the release of radioactive effluents must include, among other components, equipment and related operating procedures to monitor, sample, and conduct surveillance of effluent streams containing radioactive materials. RG 1.143 provides guidance in assigning safety classifications to RWMS with PERMISS interfaces against natural phenomena and man-induced hazards. The review conducted in this SRP section, with supporting information from SRP Sections 11.2, 11.3, and 11.4, evaluates the methods

and results used to demonstrate compliance with these requirements using NRC and industry guidance in developing operational programs.

Meeting the guidance of SRP Section 11.5 and RG 1.143 provides reasonable assurance that the requirements of GDC 60 will be met and that releases of radioactive materials during normal operations and AOOs will not result in offsite radiation doses that exceed the limits and design objectives specified in the regulations.

6. Compliance with GDC 63 and 64 requires installation of systems to monitor radioactive waste facilities for excessive radiation levels, and evaluate radioactive effluent discharge paths and the plant's environs for radioactivity released during normal operation, AOOs, and postulated accidents. This SRP section relates to GDC 63 and 64 because it focuses on monitoring radiation levels within the plant, as well as radioactivity levels in effluent streams and plant environs, expected during normal operations, AOOs, and postulated accidents.

   In addition, the requirements of GDC 64 support the implementation of requirements specified in 10 CFR 50.34(f)(2)(viii), 10 CFR 50.34(f)(2)(xiv)(E), 10 CFR 50.34(f)(2)(xvii), 10 CFR 50.34(f)(2)(xxvi), and 10 CFR 50.34(f)(2)(xxvii). RG 1.21, RG 1.33, RG 1.151, and RG 4.15 provide guidance on radiological monitoring programs for normal operation and AOOs. ANSI N42.18-2004 and ANSI/HPS N13.1-2011 provide guidance on the selection and use of continuous radiation monitoring equipment and methods in sampling airborne radioactive materials in nuclear facilities. This version of the ANSI/HPS N13.1 standard differs significantly from the 1969 version in that it is now a performance based standard, rather than one based on prescriptive rules relying on isokinetic sampling. As noted in the Foreword to ANSI/HPS N13.1-2011, the approach to achieving representative effluent sampling presented in the revised standard represents a departure from the methodology recommended by the previous version of this standard. The standard notes that by shifting from prescriptive rules and focusing instead on quantitative performance, the standard provides a method which should result in much lower sample losses during sampling and, therefore, yield samples that are more representative of the sampled stream.

   The guidance cited above also provides information on the requirements of QA programs. In addition to RG 4.15, the review addresses the process used to develop, review, verify, validate, and audit digital computer software used in radiation monitoring and sampling equipment. This aspect addresses software developed by the applicant, purchased through a vendor, or included with the instrumentation.

   For processing systems equipped with automatic control features relying on radiation detectors. The design should provide the justification for the placement of valves and dampers to isolate or divert flows in process piping and effluent exhaust vents and stacks to ensure their timely closures upon the detection of elevated radioactivity levels. If part of the design, information should be included when controls are used to monitor deviations in-plant exhaust flow rates and terminate releases or isolate process flows when deviations exceed preset limits. Other considerations may include determining whether system logic demands that a valve or damper should fail in the closed position in protecting the system from further contamination, terminating releases to the

environment, or diverting process streams or effluents to appropriate treatment systems. Acceptable guidance is presented in SRP Section 11.5 and ANSI N42.18-2004.

The review conducted in this SRP section, with supporting information from SRP Sections 11.2, 11.3, and 11.4, evaluates the methods and results used to demonstrate compliance with these requirements using NRC and industry guidance in developing operational programs. Meeting the above noted guidance provides reasonable assurance that the requirements of GDC 63 and GDC 64 will be met and that the levels of radioactivity in effluents from nuclear power plants will not exceed specified limits and design objectives.

7. The requirements specified in 10 CFR 50.34(f)(2)(viii), 10 CFR 50.34(f)(2)(xiv)(E), 10 CFR 50.34(f)(2)(xvii), 10 CFR 50.34(f)(2)(xxvi), and 10 CFR 50.34(f)(2)(xxvii) include provisions for monitoring gaseous and liquid effluents from all potential accident release points.

   In examining the applicant's system for sampling process streams and effluents under accident conditions, the review considers the guidance of RG 1.97; RG 1.101; SRP Chapter 7; BTP 7-10; NUREG-0933; NUREG-0737, Items II.B.3 (Clarification Items 1, 3, 6, and 11); Item II.E.4.2 (Clarification Items 2, 5, and 7 and Attachment 1); Item II.F.1, Attachment 1 on noble gas effluent monitors; Item III.D.1.1 (Clarification Items 1 and 3), Item III.D.3.3 (Clarification Items 1 to 4); and letter from D.G. Eisenhut, dated August 16, 1982. Using the guidance of SRP Sections 9.3.2 and 13.3, the applicant's emergency plan and implementing procedures should address these aspects in the emergency plan and implementing procedures. For any portion of the PERMISS accident monitoring systems that supports safety-related functions, as identified by the applicant, the review of these design features is performed under SRP Chapter 7 using the guidance of RG 1.97 and BTP 7-10. The review, using RG 1.97 and RG 1.151, addresses the performance, design, qualification, display, QA, and selection of monitoring variables of radiation monitoring equipment required for accident monitoring and sampling.

   If the provisions do not address post-accident sampling, the review should instead focus on the "Notice of Availability for Referencing in License Amendment Applications Model Safety Evaluation on Technical Specification Improvement to Eliminate Requirements on Post-Accident Sampling Systems using the Consolidated Line Item Improvement Process." Under this notice, the applicant should describe contingency plans for obtaining and analyzing highly radioactive samples from specific systems, maintain a capability for classifying fuel damage events at the Alert Level threshold, and maintain the capability to monitor radioiodines that have been released into unrestricted areas.

8. 10 CFR 20.1301(e) requires that facilities licensed by the NRC comply with the EPA generally applicable environmental radiation standards of 40 CFR Part 190 for facilities that are part of the fuel cycle. The EPA annual dose limits are 0.25 millisievert (mSv) (25 millirem) to the whole body, 0.75 mSv (75 mrem) to the thyroid, and 0.25 mSv (25 mrem) to any other organ.

   Meeting the requirements of 10 CFR 20.1301(e) requires the consideration of all potential sources of external radiation and radioactivity, including liquid and gaseous effluents, external radiation exposures from buildings, storage tanks, radioactive waste

storage areas, and N-16 skyshine from BWR turbine buildings. The EPA standards apply to the entire site or facility, which may have either single or multiple units. SRP Sections 11.2, 11.3, and 11.4 address sources of radioactivity and doses associated with liquid and gaseous effluents and solid wastes. SRP Section 12.3-12.4 addresses sources of radiation and external radiation exposures from buildings, storage tanks, radioactive waste storage areas, and from BWR turbine buildings. NUREG-0543 presents information and guidance in demonstrating compliance with the EPA standards.

For OL and COL applicants with site-specific information on the locations of offsite dose receptors, compliance with the EPA standards requires consideration of whether doses due to gaseous and liquid effluent releases and external radiation are additive or need to be addressed separately given actual exposure pathways. The location of offsite dose receptors and the determination of actual exposure pathways should be based on the results of a current land use census for the site. If there is no site-specific information, the review should confirm that the applicant has assumed that all exposures occur at one location or in one sector in bounding dose estimates, where doses from liquid and gaseous effluent releases and external radiation are summed up and compared to the EPA standards. In such instances, the review should assess whether the applicant has made a commitment to reassess compliance with the EPA standards by appropriately assigning doses with actual exposure pathways once site-specific information becomes available on their locations within the vicinity of the site.

9. 10 CFR 50.65(a) requires the implementation of a program to monitor the effectiveness of maintenance of SSCs important to safety, including those that are relied upon to mitigate plant AOOs, transients, and accidents.

   In examining the applicant's monitoring program, the review applies the guidance of RG 1.160 as it relates to the maintenance of PERMISS systems that are important to the protection of public health and safety. The evaluation of the maintenance program should consider systems that include radiation monitoring equipment, as described in this SRP section, radiation protection features described in SRP Section 12.3-12.4, and those that are used in plant emergency operating procedures. The review should confirm that the radiation monitoring equipment and their use in the context of emergency procedures provide the means of fulfilling their intended functions and can be relied upon to mitigate AOOs, transients, or accidents.

III. REVIEW PROCEDURES

The review procedures are based on the identified SRP acceptance criteria. The review should confirm that the applicant has submitted sufficient information for the staff to conduct an independent evaluation of any proposed alternative method and demonstration of compliance with NRC regulations and conformance with SRP guidance and SRP acceptance criteria, and supporting regulatory guidance. For deviations from these acceptance criteria, the staff should review the applicant's justification and evaluation of how the proposed alternatives provide an acceptable method of complying with the relevant NRC requirements identified in Subsection II.

While the PERMISS has been categorized as nonsafety-related and nonrisk-significant, the failure of specific systems or components may have some impacts on the means to control and

monitor liquid and gaseous effluent releases and in complying with NRC regulations under 10 CFR Part 20 and 10 CFR Part 50, Appendix I. As such, the review of the PERMISS requires a detailed review to assess whether a failure of any PERMISS component might have an impact on demonstrating compliance with the requirements of 10 CFR Part 20, Appendix B, Table 2, effluent concentration limits and dose limits to members of the public and design objectives and ALARA provisions of 10 CFR Part 50, Appendix I. The applicant's FSAR and failure analysis will be reviewed to confirm that sufficient information has been provided to confirm that the failure of essential systems will not result in plant or operating conditions in noncompliance with NRC regulations on exposure to workers and members of the public and that the supporting information presented in the FSAR is consistent with SRP acceptance criteria.

The information describing the design features of the PERMISS provided in the FSAR, or the COL application to the extent not addressed in a referenced certified design, including referenced sections of SRP Sections 11.1, 11.2, 11.3, 11.4, 11.5, and 12.3-12.4, is reviewed for completeness in accordance with RGs 1.70 or RG 1.206. While the SRP references RG 1.70 and RG 1.206, not all sections of RG 1.70 have a corresponding review plan section. The SRP sections applicable to a COL application for a new LWR, submitted under 10 CFR Part 52 are based on RG 1.206.

1. Programmatic Requirements. Commission regulations and policy mandate “programs” applicable to SSCs that include:

   A. Maintenance Rule (RG 1.160, and SRP Sections 17.6 and 13.4, Table 13.4, Item 17), as they relate to radiation monitoring instrumentation used to control and monitor effluent releases and RWMS systems to treat or mitigate effluent discharges during AOOs and accidents and use in plant EOPs.

   B. Technical specifications (SRP Chapter 16 and TS 5, Administrative Controls). The associated TS are presented in NUREG-1430, NUREG-1431, NUREG-1432, NUREG-1433, and NUREG-1434. The TS include the RETS/SREC and ODCM, and other operational programs described above to augment the TS. The review of the RETS/SREC, ODCM, and REMP may be conducted as part of the review of SRP Section 11.4 depending on where the applicant has located the procedural details and programmatic controls, given the provisions of GL 89- the programs with the generic operational programs described in SECY-05-0197 and inclusion in FSAR (Table 13.4-x) as license conditions.

   C. Initial Plant Test Program it relates to tests and test acceptance criteria for process and effluent radiation monitoring instrumentation and sampling systems, using the guidance of RG 1.68 and SRP Sections 14.2 and 13.4, Table 13.4, Item 19.

   D. Implementation of these programs will be inspected in accordance with NRC Inspection Manual Chapter (IMC)-2504, “Construction Inspection Program - Non-ITAAC Inspections.”

   E. If applicable, the staff reviews the proposed augmentation of programmatic elements in assessing the adequacy of the PERMISS design and resulting effects on the development of the RETS/SREC and ODCM. The staff’s

evaluation and conclusion of the acceptability of the augmented programmatic elements is addressed in SER Section 13.4 and relevant requirements and guidance identified in this SRP section for the systems and components identified in the supplemental or new programmatic elements.

2. In accordance with 10 CFR 52.47(a)(8), 10 CFR 52.47(a)(21), 10 CFR 52.47(a)(22), 10 CFR 52.79(a)(17), and 10 CFR 52.79(a)(20), for new reactor license applications, the applicant is required to (1) address the proposed technical resolution of unresolved safety issues and medium- and high-priority generic safety issues (GSIs) that are identified in the version of NUREG-0933 current on the date 6 months before application is submitted as technically relevant to the design; (2) demonstrate how the operating experience insights have been incorporated into the plant design; and, (3) provide information necessary to demonstrate compliance with technically relevant portions of the TMI requirements set forth in 10 CFR 50.34(f), except for paragraphs 10 CFR 50.34 (f)(1)(xii), 10 CFR 50.34 (f)(2)(ix), and10 CFR 50.34 (f)(3)(v). With respect to NUREG-0933, TMI Action Plan Items, Task III.D (Radiation Protection) and Task III.D.2 (Public Radiation Protection Improvement), the applicant should describe design features of the RWMS that are used to control and reduce potential exposures to offsite populations following an accident. With respect to GIS, the applicant should present an evaluation of the issues listed in NUREG-0933 and, depending upon their applicability to the design, present information that demonstrates implementation of acceptance criteria. These cross-cutting review areas should be addressed by the reviewer for each technical subsection and relevant conclusions documented in the corresponding SER section.

3. In the review of the PERMISS, the reviewer compares the listing of process and effluent monitors contained in the application with the principal release points identified in SRP Sections 11.2 to 11.4 to ensure that all major process streams and release pathways are being monitored during normal operation, AOOs, and postulated accidents. The comparison includes radiation monitoring systems that are used for plant safety and radiation protection, monitoring plant operation (including the operation of the LWMS, GWMS, and SWMS), monitoring and controlling liquid and gaseous effluent releases to unrestricted areas, and instrumentation used for monitoring intersystem leakage among plant systems. In addition, the review addresses the means to monitor nonradioactive systems that could become contaminated with radioactivity through interfaces with radioactive systems. At a minimum, the review includes the following:

   A. The types and numbers of instruments, number of instrumentation channels, location of detectors, types and placement of radioactive check sources, sampling points, and process and effluent sampling stations. The basis for the selection of these sampling or monitoring points are compared with the general principles and criteria for obtaining valid samples of radioactive materials from liquid and gaseous process and effluent streams. The review considers the methods and materials used in gaseous and particulate sampling equipment and the guidance for sampling from ducts and stacks using the guidance of RG 4.15, and ANSI N42.18-2004 and ANSI/HPS N13.1-2011.

   B. In ensuring representative sample collection, the review compares equipment design features, layout, piping, and description of sampling methods to the

guidance of RG 1.21, RG 1.143, and RG 4.15, and industry guidance of ANSI N42.18-2004 and ANSI/HPS N13.1-2011.

C. The review includes an independent evaluation of radioactivity levels and radionuclide concentrations in process and effluent streams using the models and guidance of SRP Section 11.1 (NUREG-0016, "Calculation of Releases of Radioactive Materials in Gaseous and Liquid Effluents from Boiling-Water Reactors," or NUREG-0017, "Calculation of Releases of Radioactive Materials in Gaseous and Liquid Effluents from Pressurized-Water Reactors") and guidance of RG 1.112, "Calculation of Releases of Radioactive Materials in Gaseous and Liquid Effluent from Light-Water-Cooled Power Reactors," in confirming the applicant's estimates of expected radioactivity levels and radionuclide concentrations during normal operations and AOOs.

D. For nonsafety-related systems, the review considers the interfaces of radiation monitoring instrumentation with plant systems, including provisions for automatic control features and interdependence with other types of system parameters (e.g., fluid level, valve or damper positions, and system pressure, flow rate, and temperature), using the guidance presented in this SRP section, and that of RG 1.21 and RG 4.15, ANSI N42.18-2004, and Appendix 11.5-A to this SRP section. In ensuring compliance with regulations, the review addresses the types and placement of such radiation detectors in plant systems, operational ranges and qualification of radiation or radioactivity levels in supporting the functions of radiation monitoring systems. The functional interdependence and logic in alarming and terminating or diverting process or effluent streams include: (1) in complying with doses for members of the public, (2) in complying with effluent concentration limits under 10 CFR Part 20, and (3) avoid exceeding the design objectives of Appendix I to 10 CFR Part 50. The review addresses the derivation of alarm setpoints in notifying control room operators and initiating automatic control functions. The review and evaluation of instrumentation used for the protection of plant workers are addressed in SRP Sections 12.3-12.4, 12.5, and 13.3. The review also considers design features that would prevent radioactive contamination of otherwise nonradioactive plant systems, and unmonitored and uncontrolled releases of radioactive materials in the environment. The reviewer will determine whether the design and operational features of the PERMISS comply with NRC regulations, are consistent with NRC and industry guidance on radiation monitoring and sampling, and confirm that the acceptance criteria of this SRP section have been met.

E. For safety-related functions assigned to portions of PERMISS accident monitoring operation, the reviewer compares and evaluates design features, performance, design, qualification, display, QA, and selection of monitoring variables of radiation monitoring equipment required for accident monitoring and sampling using the guidance of SRP Chapter 7 and SRP Section 13.3 and that of RG 1.97, RG 1.151 and BTP 7-10.

F. In the review of the P&IDs for the liquid and gaseous waste treatment systems, the reviewer verifies that specifically identified radioactive release points have provisions for automatic termination or diversion of releases in the event that they

exceed a predetermined alarm level. The reviewer compares the provisions for instrumentation with automatic termination of releases to the design guidance in Appendix 11.5-A to this SRP section.

G. The reviewer evaluates the location of the radiation monitors, collocated sampling points shown on system P&IDs and placements of readouts and annunciation panels, and alarms described in applying the guidance of SRP Chapter 7. The review considers whether design features and information on implementation are consistent with the acceptance criteria in ensuring that plant operators will be advised of instrumentation responses on effluent release rates or effluent concentrations in assessing compliance with NRC dose and release limits, as implemented in the plant's RETS/SREC and ODCM.

H. The reviewer compares the proposed calibration methods (i.e., electronic and via the use of the National Institute of Standards and Technology traceable radioactive standards and check sources) and frequency of calibrations with the guidance of RG 1.21, RG 1.33, and RG 4.15. The review of instrumentation calibrations considers whether instrumentation response is expected to change given that radionuclide distributions may vary with the operating status of the plant (i.e., normal operation, AOOs, and during accident and post-accident conditions).

I. The reviewer confirms that adequate documentation exists to confirm the verification and validation of digital computer software used in radiation monitoring and sampling equipment, including software used to terminate or divert process and effluent streams. This evaluation includes software developed by the applicant, purchased through a vendor, or included with the instrumentation. Other considerations may include determining whether system logic demands that a valve or damper fail in the closed position in protecting the system from further contamination, terminating releases to the environment, or diverting process streams or effluents to appropriate treatment systems. Acceptable guidance is presented in this SRP Section and American Nuclear Society (ANS) N42.18-2004.

J. The reviewer ensures that the design allows detectors to be replaced or decontaminated without opening the boundary of the process system or without losing the capability to isolate the system or divert effluents to tanks or standby treatment systems (as appropriate).

K. The reviewer evaluates, on a case-by-case basis, the use of special system design features or reliance on applicable topical reports, as well as data referenced in the application that are applied as technical basis beyond NRC guidance.

4. The reviewer evaluates programs and procedures described in the applicant's proposed RETS/SREC, REMP, and ODCM for the PERMISS. The reviewer determines that the applicant's RETS/SREC, REMP and ODCM meet the requirements of 10 CFR 50.34a and 10 CFR 50.36a, Appendix I to 10 CFR Part 50 design objectives for maximally exposed offsite individual doses (Section II); Sections III and IV of Appendix I to

10 CFR Part 50 regarding the implementation of Appendix I criteria; effluent concentration limits of Appendix B (Table 2, Columns 1 and 2, and Note 4) to 10 CFR Part 20; and dose limits of 10 CFR 20.1301 and 10 CFR 20.1302 for members of the public, and 10 CFR 20.1301(e) in assessing total dose from all sources of radioactivity and radiation. The review addresses the consistency of the programs with the generic operational programs described in SECY-05-0197 and inclusion in FSAR (Table 13.4-x) as license conditions. For applications that refer to the NEI ODCM Template 07-09A (Revision 0, March 2009) in complying with this regulatory milestone, no other review of the RETS/SREC, REMP, and ODCM programs is necessary under this SRP section since the NEI ODCM Template 07-09A has been reviewed and found acceptable by the staff (ADAMS Accession No. ML083530745). Instead, the staff reviews SRP Section 13.4 of the technical submittal to ensure that the RETS/SREC, REMP, and ODCM are included as license conditions for the development of a plant and site-specific program before fuel load.

For plant and site-specific RETS/SREC, REMP, and ODCM programs, the format and content of the RETS/SREC, ODCM, and REMP should be consistent with the provisions of GL 89-01 and the guidance of NUREG-1301 (PWRs) or NUREG-1302 (BWRs) and NUREG-0133 for either type of reactor, Radiological Assessment BTP (Revision 1, November 1979); and guidance of RG 1.21; RG 1.33; RG 4.1, “Programs for Monitoring Radioactivity in the Environs of Nuclear Power Plants”; RG 4.8, “Environmental Technical Specifications for Nuclear Power Plants”; and RG 4.15. The review includes the evaluation of the following operational documents:

A. RETS/SREC—Review of the TS (i.e., administrative controls section) proposed by the applicant for process and effluent control is performed for input to the review of SRP Chapter 16 (and TS on Administrative Controls), and in this SRP section for the RETS/SREC. The reviewer determines that the elements and scope of the programs identified in the administrative controls section of the TS agree with the requirements identified as a result of the staff’s review. The review includes the evaluation or development of appropriate limiting conditions for operation or controls and their basis, consistent with the plant design. For the RETS/SREC, the review determines whether the following elements are addressed and meet regulatory requirements and guidance noted above for liquid and gaseous effluents. The review addresses surveillance requirements and controls; operational conditions of radiation monitoring and sampling equipment; required number of operational channels; conduct and frequencies of channel checks, source checks, channel calibrations, and channel functional checks; compliance with action statements and remediation whenever the number of operational channels and applicability are less than the required minimum; sampling and analysis programs for continuous and batch mode releases, including provisions for the collection of grab and composite samples; and derivations of lower limit of detections by categories of effluents or radionuclides and types of radiological analyses. The programs identified in the administrative controls section of the TS and elements of the RETS/SREC are reviewed using the provisions of GL 89-01 and NUREG-1301 or NUREG-1302.

B. ODCM—The ODCM is reviewed to determine whether descriptions of the methodology and parameters used for calculating offsite doses to members of

the public, resulting from gaseous and liquid effluent releases, meet the regulatory requirements and guidance noted above. The procedural details and programmatic elements of the ODCM should be based on the guidance of NUREG-1301 (PWRs) or NUREG-1302 (BWRs) and NUREG-0133 and NUREG-0543 for either type of reactor. The ODCM should describe the methods used to calculate doses in accordance with the guidance of RGs 1.109, "Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I," and RG 1.111, Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water-Cooled Reactors," or RG 1.113, "Estimating Aquatic Dispersion of Effluents from Accidental and Routine Reactor Releases for the Purpose of Implementing Appendix I," using appropriate computer codes (e.g., LADTAP II (NUREG/CR-4013, "LADTAP II—Technical Reference and User Guide," issued April 1986) for liquid effluents and GASPAR II (NUREG/CR-4653, "GASPAR II—Technical Reference and User Guide," issued March 1987)) for gaseous effluents.

The ODCM should (1) identify all liquid and gaseous effluent release points and the types and locations of installed radiological instrumentation used to monitor and control effluent releases, (2) describe parameters and provide justification of values used to derive effluent release rates and alarm setpoints, including the basis of dilution factors for liquid effluents (in-plant and beyond the point of release in unrestricted areas) and atmospheric dispersion (X/Q) and deposition (D/Q) factors for gaseous and particulate effluents, (3) provide specifications for maximum radioactivity levels in tanks containing liquids and offgas systems and descriptions of protective measures applied to spills and leaks from such components, (4) identify locations of offsite dose receptors and the basis for their selection using the results of annual land use census surveys, (5) describe criteria used to determine the operability of waste treatment systems and requirements in conducting dose projections, such as whenever treatment systems are not fully utilized, or in assessing monthly, quarterly, and yearly doses, and (6) define administrative and operational procedures associated with the implementation of the ODCM.

For sites with applicants and licensees operating two or more reactors, each applicant and licensee should include in their respective ODCMs a process for notifying the other licensees on the same site to ensure that, when combined, effluent concentrations and offsite dose limits of 10 CFR Part 20 are not exceeded. The operation of two or more plants will be contributing to and sharing a single dose allocation for members of the public under 10 CFR 20.1301 and 10 CFR 20.1302; 10 CFR 20.1301(e) in complying with 40 CFR Part 190; and liquid and gaseous effluent concentration limits of 10 CFR Part 20, Appendix B, Table 2, Columns 1 and 2, and Note 4 for radionuclide mixtures. The notification process should include the means by which releases of liquid and gaseous effluents can be coordinated and controlled such that all licensees on the site are jointly aware of routine and planned releases, including those associated with AOOs as they occur. The review should confirm that each applicant and licensee has acknowledged the need for such arrangements and

that commitments have been made to formalize such arrangements in their respective ODCMs and implementing procedures.

The review evaluates the description of programs and procedures addressing QA and quality control supporting the implementation of the ODCM, the description of information to be contained in annual radiological effluent release reports, the listing of requirements mandating reports to the NRC, and the process for initiating and documenting changes to the ODCM and its supporting procedures.

The review of the ODCM may be conducted as part of the review of SRP Section 11.4 depending on where the applicant has located the procedural details and programmatic controls of the ODCM in the PCP, given the provisions of GL 89-01 and NUREG-1301 or NUREG-1302.

C. REMP—The REMP is reviewed to determine whether the program provides the means to monitor and quantify radiation and radioactivity levels in the environs of the plant associated with gaseous and liquid effluent releases and direct external radiation exposures from contained sources of radioactive materials in tanks and equipment and in buildings, and N-16 skyshine from BWR turbine buildings. The REMP demonstrates compliance with the regulatory requirements and conformance with NRC guidance noted above. The procedural details and programmatic elements of the REMP should be based on the guidance of NUREG-1301 or NUREG-1302, Radiological Assessment BTP (Revision 1, November 1979), and guidance of RG 1.21, RG 4.1, RG 4.8, and RG 4.15.

The REMP should describe the process and methods for monitoring, sampling, and analyzing environmental samples representative of expected radionuclide distributions and concentrations in environmental media and associated exposure pathways. The REMP should identify the type, number, sampling locations, sample volume or weight, and sampling and analytical frequencies of environmental samples. The types of samples should include cow or goat milk and milk products, surface and ground water, fish and invertebrates, meat and poultry and meat products, fruits and vegetables, leafy vegetables, grains, other local food products, sediments and soils, and air. The selection of sampling locations and types of samples, including control sample locations, should be based on the results of a yearly land use census to ensure that changes in exposure pathways are identified and that modifications are made to the monitoring program to reflect such changes. In assessing direct external radiation exposures, the REMP should identify sources of radiation and radioactivity, such as tanks and equipment, waste storage buildings, spent-fuel storage, and N-16 skyshine from BWR turbine buildings; types of measurement methods used at each location; and locations of monitoring stations around plant facilities, including those used to monitor doses to nearest offsite receptors. The REMP should define the detection limits and reporting levels for all expected radionuclides and environmental samples and external radiation monitoring methods. The review evaluates information describing participation in an inter-laboratory comparison program to assess the precision and accuracy of measurements of radioactivity in environmental samples as part of the QA program.

The review of the REMP evaluates (1) administrative and operational procedures associated with its implementation, (2) descriptions of programs and procedures addressing QA and quality control supporting its implementation, (3) description of information to be contained in annual radiological environmental operating reports, (4) listing of requirements mandating reports to the NRC, and (5) process for initiating and documenting changes to the REMP and its supporting procedures.

The review of the REMP is conducted as part of the review of this SRP section, depending on where the applicant has located the procedural details and programmatic controls of the REMP in the ODCM or PCP, given the provisions of GL 89-01 and NUREG-1301 or NUREG-1302.

D. The PCP and associated plant TS (Administrative Controls) are reviewed to determine whether they identify all regulatory requirements, follow NRC guidance, and contain all appropriate operational elements. The review of the PCP may be conducted as part of the review of SRP Section 11.4 or as part of the review of this SRP section, depending on where the applicant has located the procedural details and programmatic controls of the PCP, given the provisions of GL 89-01 and NUREG-1301 or NUREG-1302. SRP Section 11.4 addresses the review and evaluation of the PCP and identifies the regulatory requirements associated with the handling, processing (e.g., dewatering, solidification, and compaction), characterization, packaging, and shipment of radioactive wastes to authorized low-level waste disposal sites or licensed waste processors.

E. If applicable, the staff reviews the proposed augmentation of programmatic elements in assessing the adequacy of the PERMISS design and resulting effects on the development of the RETS/SREC and ODCM. The staff's evaluation and conclusion of the acceptability of the augmented programmatic elements is addressed in SRP Section 13.4 and relevant requirements and guidance identified in this SRP section for the systems and components identified in the supplemental or new programmatic elements.

5. To the extent not covered in SRP Sections 11.2 and 11.3, the design of sampling components and sample tanks and their placement in buildings should include provisions to reduce leakage and facilitate operations and maintenance. The design and layout should be compared to the guidance of RG 4.21 and RG 1.143 for liquid wastes and venting of tanks and components. RG 1.143 describes design guidance acceptable to the NRC staff related to seismic, safety, and quality group classifications and QA provisions for LWMS and GWMS subsystem interfaces with PERMISS components. Compliance with RG 1.143 provides reasonable assurance that the assigned safety classifications for structures housing the LWMS and GWMS and their components comply with the requirements of GDC 2 and GDC 61.

6. For liquid and gaseous process radiation monitoring equipment not covered by the ODCM, the review should confirm that the applicant, even when referencing a DC, provides information describing methods and procedures that will be used in deriving lower limits of detection or detection sensitivities, and set-points (alarms and process termination/diversion) for process radiation monitoring equipment. The review should

determine whether the applicant has made specific commitments to develop a plant-specific process and radiological sampling and analysis plan for systems not covered by the ODCM, including provisions describing sampling and analytical frequencies, and radiological analyses for the expected types of liquid and gaseous samples and waste media generated by the LWMS, GWMS, and SWMS. The review should confirm that the proposed sampling and analytical frequencies, and radiological analyses are commensurate with expected levels of radioactivity in associated systems. The review should also confirm that procedurally, the results of such radiological analyses would be integrated in plant procedures used to assess the performance of process and effluent treatment systems.

7. For an applicant that references a DC and that chooses to install and operate skid-mounted radiation monitoring and sampling systems connected to permanently installed waste management systems, the review should determine whether the applicant has provided sufficient plant-specific information describing how the design and operating features are integrated with the PERMISS. The review should also address the requirements of 10 CFR 20.1406 and NRC guidance of RG 4.21 and RG 1.143, Inspection and Enforcement (IE) Bulletin No. 80-0, "Contamination of Nonradioactive System and Resulting Potential for Unmonitored, Uncontrolled Release of Radioactivity to Environment," dated May 6, 1980; and industry guidance of ANSI/HPS-13.1-1999, "Sampling and Monitoring Releases of Airborne Radioactive Substances from the Stacks and Ducts of Nuclear Facilities," issued 1999; ANSI N42.18-2004; and NEI 08-08A.

8. For process instrumentation and methods used to quantify RCS leakage and leakage rates, and steam generator tube integrity and leakage rate, the technical review should, in part, be based on the plant's TS, as described in the applicable sections of SRP Chapter 16 (TS 16.3.4), and SRP Section 5.2.5 and SRP Section 10.4.8, Steam Generator Blowdown System (PWR)." The associated TS are presented in NUREG-1430, NUREG 1431, NUREG-1432, NUREG-1433, and NUREG-1434. To the extent not covered in SRP Sections 5.2.5, 10.4.8, and 12.3-12.4, the review will assess whether the design incorporates NRC and industry guidance, including that of BTP 5-1, RG 1.45, IN 2005-24, RIS 2007-20, "Implementation of Primary-to-Secondary Leakage Performance Criteria," dated August 23, 2007;and RIS 2009-02 (Revision 1), "Implementation of Primary-to-Secondary Leakage Performance Criteria," dated August 23, 2007; and NEI 97-06; and EPRI Reports No. 1013420, "Pressurized-Water Reactor Primary Water Zinc Application Guidelines," issued December 2006; EPRI Report No. 1008224, "PWR Secondary Water Chemistry Guidelines," Draft Revision 6, issued December 2004; and EPRI Report No. 1008219, "PWR Primary-to-Secondary Leak Guidelines," Revision 3, issued December 2004. NRC and industry guidance describes and establishes acceptable means by which to satisfy radiation monitor sensitivity requirements in detecting RCS leakage rates over specified time periods, using a realistic primary coolant concentration, and primary to secondary leakage through any one steam generator. The evaluation should consider descriptions of radiation monitors used to satisfy TS, specify minimum radiation monitor sensitivities given in the DC and TS on RCS and steam generator tube leakage rates, indicate whether noble gas radiation monitors will be used to supplement the containment particulate radiation monitor, and provide descriptions of models, methods, and

assumptions used in calculations supporting the stated radiation monitor sensitivity levels and conformance with TS.

9. The PERMISS is reviewed to ensure that the design includes provisions to prevent and collect leakage and spillage associated with sample collection, processing, storage, and operation of skid-mounted monitoring and sampling equipment conform to the guidance of RG 1.143 and RG 4.21 in meeting the requirements of 10 CFR 20.1406.

   The review should confirm whether design features are included to return samples collected from process and effluents streams to their origins, and prevent sampled streams from being discharged locally or released to the environment without being treated and monitored using the guidance of RG 1.143 and RG 4.21 and NEI 08-08A. The review should evaluate provisions in purging and flushing sampling lines and monitors with nonradioactive fluids (e.g., clean water, air, inert gases) and route purged or flushed fluids to the LWMS and GWMS. In addition, the review should confirm that the source of nonradioactive purging or flushing fluid is protected from radioactive cross-contamination using appropriate measures, such as check valves, backflow preventers, interlocks, differential pressures, etc.

   The review considers information describing design features that will minimize, to the extent practicable, contamination of the facility and environment; facilitate eventual decommissioning; and minimize, to the extent practicable, the generation of extraneous radioactive wastes associated with the operation of the PERMISS as a result of operator error and processing equipment failures or malfunctions. In addition, the review may also consider the information contained in the DC application, SAR design updates, or the COL application to the extent not addressed in a referenced certified design.

   In addressing the above, the NRC guidance includes the following:

   A. RG 1.143 and RG 4.21 for system process streams, gaseous and liquid wastes, and gaseous and liquid effluents produced during normal operation and AOOs; and NUREG/CR-3587, “Identification and Evaluation of Facility Techniques for Decommissioning of Light-Water Reactors,” issued June 1986, as it relates to techniques used in decommissioning LWRs.

   B. SRP Sections 5.2, 6.2, 9.1, 9.2, 9.3, 9.4, 10.4, 11.2, 11.3, 11.4, and 12.3-12.4.

   C. Relevant NRC bulletins, circulars, and notices (e.g., Inspection and Enforcement (IE) Bulletin No. 80-10; Circular 77-14, Separation of Contaminated Water Systems from Uncontaminated Plant Systems,” dated November 22, 1977; Circular 79-21, “Prevention of Unplanned Releases of Radioactivity,” dated October 17, 1979; and Circular 81-09, “Containment Effluent Water that Bypasses Radioactivity Monitor,” dated July 10, 1981; IN 79-07, “Rupture of Radwaste Tanks,” dated March 23, 1979; IN 79-09, “Spill of Radioactively Contaminated Resins,” dated March 30, 1979; IN 86-42, “Improper Maintenance of Radiation Monitoring Systems,” dated June 9, 1986; IN 86-43, “Problems with Silver Zeolite Sampling of Airborne Radioiodine,” dated June 10, 1986; IN 91-40, “Contamination of Nonradioactive System and

Resulting Possibility for Unmonitored, Uncontrolled Release to Environment," dated June 19, 1991; IN 2004-05, "Spent Fuel Pool Leakage to Onsite Groundwater," dated March 3, 2004; IN 2006-13, "Ground-Water Contamination due to Undetected Leakage of Radioactive," dated July 10, 2006; IN 2012-05, "Abnormal Releases of Radioactive Water Potentially Resulting in Groundwater Contamination," dated April 25, 2012; and RIS 2008-03, "Return/Reuse of Previously Discharged Radioactive Effluents," dated February 13, 2008).

D. Industry guidance and standards, (e.g., NEI 08-08A; (ANS) N42.18-2004; ANSI/ANS-55.6-1993, "Liquid Radioactive Waste Processing System for Light-Water Reactor Plants," reaffirmed (2007); ANSI/ANS-55.4-1993, "Gaseous Radioactive Waste Processing Systems for Light Water Reactor Plants," reaffirmed 2007 (2007); ANSI/ANS-40.37-2009, "American National Standard, Mobile Low-Level Radioactive Waste Processing Systems," issued 2009; and ANSI/HPS-13.1-1999.

E. Applicable NEI, EPRI, and Technical Specifications Task Force guidance on steam generator program and guidance on secondary coolant chemistry and steam generator tube integrity; and operability requirements and actions for RCS leakage detection and instrumentation. Applicant should identify which specific guidance is incorporated by reference and how it will be implemented in specific operational programs and plant TS.

F. RG 4.21 provides guidance on implementing the requirements of 10 CFR 20.1406(a) and 10 CFR 20.1406(b) to design facilities and develop operations procedures to minimize radioactive waste generation and facility contamination, as discussed earlier. The NRC staff's SER associated with NEI technical report NEI 08-08A (ADAMS Accession No. ML093220530) provides the basis for the use of the template to describe an acceptable operational ground water protection program which conforms to the guidance of RG 4.21 for applications submitted after August 20, 1997. Regulatory Positions of C.4 and C.5 of RG 4.22, "Decommissioning Planning during Operations," provide guidance (not discussed in RG 4.21) for complying with 10 CFR 20.1406(c) and 10 CFR 20.1501 to minimize the introduction of radioactive materials in plant facilities and environment, document the results of radiological surveys conducted during plant operation in characterizing radiological contamination, and plan decommissioning at the time of license termination.

10. In determining compliance with the EPA generally applicable environmental radiation standards of 40 CFR Part 190, as implemented under 10 CFR 20.1301(e), the review confirms that the ODCM includes the appropriate methodology to account for all sources of radiation and radioactivity contained in liquid and gaseous effluent discharges as potential contributors to doses to members of the public from the site, which may have multiple reactor units. The review focuses on methods used to assess the total dose from sources of radioactivity, external radiation exposures from waste processing buildings, waste storage buildings, waste storage tanks, temporary waste storage or staging areas, spent-fuel storage, and N-16 skyshine from BWR turbine buildings. The source terms and associated doses from liquid and gaseous effluent

discharges associated with the operation of the LWMS, GWMS, and SWMS are evaluated using the guidance in SRP Sections 11.2 to 11.4. Doses associated with external radiation from buildings and sources of radioactivity contained in systems and components are evaluated using the guidance in SRP Sections 11.1 and 12.3-12.4.

The reviewer should determine whether the applicant has applied site-specific information in assigning doses for all identified exposure pathways, or instead has assumed that all exposures occur at one location or in one sector in bounding dose estimates, where doses from liquid and gaseous effluent releases and external radiation are summed up and compared to the EPA standards. For OL and COL applicants with site-specific information on the locations of offsite dose receptors, compliance with the EPA standards should provide the justification on the apportionment of doses due to liquid and gaseous effluent releases and external radiation given actual exposure pathways. The location of offsite dose receptors and the determination of actual exposure pathways should be based on the results of a current land use census for the site. In such instances, the applicant should provide a commitment to reassess compliance with the EPA standards, as implemented under 10 CFR 20.1301(e), by appropriately assigning doses with actual exposure pathways once site-specific information becomes available on their locations within the vicinity of the site.

11. In 10 CFR 50.65(a) and 10 CFR 50.65(b), the NRC requires that applicants and licensees monitor the performance or condition of SSCs against licensee-established goals in a manner sufficient to provide reasonable assurance that such SSCs are capable of fulfilling their intended functions. In addition, good maintenance is also important in ensuring that failure of other than safety-related SSCs that could initiate or adversely affect a transient or accident is minimized, including those that are relied upon to mitigate accidents or transients or are used in plant EOPs (i.e., radiation monitors described in this section, or radiation protection features described in SRP Sections 12.3-12.4), 12.5, and 13.3.

12. Operational Programs. The reviewer verifies that the RETS/SREC, ODCM and REMP aspects of the process and effluent monitoring and sampling program are fully described and that implementation milestones have been identified. The review addresses the consistency of the programs with the generic operational programs described in SECY-05-0197. The reviewer verifies that the implementation of the RETS/SREC, ODCM and REMP aspects of the process and effluent monitoring and sampling program is included in the license condition for operational programs. Under the standards established by SECY-05-0197, the implementation of operational programs, including the elements identified in the RETS/SREC, ODCM, and REMP does not necessitate ITAAC in a DC or COL application, provided the program and its implementation are fully described.

The reviewer should determine whether the evaluation of the ODCM needs to be conducted as part of the review of SRP Section 11.4 in instances when the applicant has located the procedural details and programmatic controls in the PCP instead of the ODCM, given the provisions of GL 89-01 and NUREG-1301 or NUREG-1302.

If applicable, the staff reviews the proposed augmentation of programmatic elements in assessing the adequacy of the PERMISS design and resulting effects on the development of the RETS/SREC and ODCM. The staff's evaluation and conclusion of the acceptability of the augmented programmatic elements is addressed in SRP Section 13.4 and relevant requirements and guidance identified in this SER section for the systems and components identified in the supplemental or new programmatic elements.

Implementation of this program will be inspected in accordance with NRC Inspection Manual Chapter (IMC)-2504, "Construction Inspection Program - Inspection of Construction and Operational Programs."

13. For the review of DC applications, the reviewer should follow the above procedures to verify that the design, including requirements and restrictions (e.g., system interfaces and site parameters), set forth in the design control document meet the acceptance criteria. The reviewer should also consider the appropriateness of identified COL action items. The reviewer may identify additional COL action items; however, to ensure that these COL action items are addressed in a COL application, they should be added to FSAR Sections 1.8 and 1.9.

In instances where an applicant has submitted conceptual design information for portions of the plant for which the application does not seek certification, the review should confirm that the applicant has submitted sufficient details for the staff conduct its evaluation of the associated SSCs, assess the adequacy of system interfaces with other SSCs that are included in the DC, and confirm the adequacy of proposed ITAAC and methods used in verifying that all interface requirements have been met by a COL applicant under the requirements of 10 CFR 52.47(a)(24) to 10 CFR 52.47(a)(26), 10 CFR 52.79(d)(2), and 10 CFR 52.80(a).

For review of a COL application, the scope of the review is dependent on whether the COL applicant references a DC, an ESP or other NRC approvals (e.g., manufacturing license, site suitability report or topical report), or proposes other reactor technology. The staff will confirm that the applicant has properly incorporated the relevant information from the DC or that of another design into the COL application, addressed all COL action items associated with specific design aspects of SSCs (e.g., balance of plant topics not covered in the design) left to the COL applicant, and considerations driven by site-specific features.

For review of both DC and COL applications, SRP Section 14.3 should be followed for the review of ITAAC. The review of ITAAC cannot be completed until after the completion of review conducted using the guidance of this SRP section and related others, as warranted by design features.

The reviews of interfaces with certified standard designs and COL information items, and conformance with regulatory guidance (RG, SECY, RIS, bulletins, notices, and GLs) are performed using the guidance in SRP Chapter 1, "Introduction and Interfaces," Items 1.8 and 1.9.

IV. EVALUATION FINDINGS

The reviewer verifies that the applicant has provided sufficient information and that the staff's safety review and analysis, conducted as augmented by the application of programmatic requirements in accordance with the staff's review approach described in the SRP Introduction, support conclusions of the following types to be included in the staff's SER. The reviewer also states the basis for those conclusions. When programmatic elements are used to assess design adequacy and effects on the development of new or modifications of existing operational programs, the reviewer confirms that the applicant has properly identified those elements of the program in DC and COL FSAR Section 13.4 (Table 13.4-x), as supplemental elements to an existing program or as the addition of a new program.

The staff concludes that the designs of the PERMISS (as permanently installed systems or in combination with skid-mounted systems) include the equipment necessary to monitor process and effluent streams and control releases of radioactive materials associated with the operation of the LWMS, GWMS, and SWMS. The designs are found to be acceptable and meet the applicable requirements of 10 CFR 20.1301 and 10 CFR 20.1302, 10 CFR 20.1301(e), 10 CFR 20.1406; 10 CFR 50.34a, 10 CFR 50.36a, 10 CFR 50.34(f)(2)(viii), 10 CFR 50.34(f)(2)(xiv)(E), 10 CFR 50.34(f)(2)(xvii), 10 CFR 50.34(f)(2)(xxvi), and 10 CFR 50.34(f)(2)(xxvii); 10 CFR Part 50, Appendix I design objectives; and GDC 2, GDC 19, GDC 60, GDC 61, GDC 63, and GDC 64.

The reviewer states the bases for those conclusions, as listed below:

1. With respect to the operational features of the PERMISS, the applicant has included instrumentation for monitoring and sampling radioactivity for contaminated liquid, gaseous, and solid waste process and effluent streams. The staff evaluated the provisions proposed to sample and monitor all appropriate process streams and effluent release points, including nonradioactive systems that could become contaminated through interfaces with radioactive systems. The staff determined that the design and operational features are in accordance with GDC 64 and meet the requirements specified in 10 CFR 50.34(f)(2)(viii), 10 CFR 50.34(f)(2)(xiv)(E),10 CFR 50.34(f)(2)(xvii), 10 CFR 50.34(f)(2)(xxvi), and 10 CFR 50.34(f)(2)(xxvii).

2. With respect to the operational features of the PERMISS, the applicant has included provisions for automatic termination of effluent releases that ensure control over discharges in accordance with GDC 60. The provisions proposed for sampling and monitoring liquid, gaseous, and solid waste process streams under the PCP, are in accordance with GDC 63. The provisions for sampling process and effluent streams and conducting analysis of samples, including the proposed analytical programs, are in accordance with the guidance of RG 1.21, RG 1.33, RG 4.1, RG 4.8, and RG 4.15 for routine plant operation and AOOs for liquid, wet, and solid wastes.

3. With respect to the design and operational features of the PERMISS, the applicant provided sufficient information describing the types, numbers, and placement of radiation monitoring and sampling equipment in plant systems, operational ranges and qualification of radiation detectors in supporting the functions of radiation monitoring systems. The applicant described the functional interdependence and logic in alarming and terminating or diverting process or effluent streams in complying with doses for

members of the public and effluent concentration limits under 10 CFR Part 20, and avoid exceeding the design objectives of Appendix I to 10 CFR Part 50. The staff concludes that the information describing the design and operational features of the PERMISS complies with NRC regulations, consistent with NRC and industry guidance on radiation monitoring and sampling, and the staff confirms that the acceptance criteria of this section have been met. Supporting information on the staff's evaluation of the applicant's information is presented in SER Chapter 7.

4. Under the requirements of 10 CFR 50.34(f)(2) on TMI-related requirements , the applicant has included provisions for the sampling and monitoring of process and effluent streams and conducting analysis of samples, including the proposed analytical programs, during postulated accidents in accordance with the requirements of 10 CFR 50.34(f)(2)(viii), 10 CFR 50.34(f)(2)(xiv)(E), 10 CFR 50.34(f)(2)(xvii), 10 CFR 50.34(f)(2)(xxvi), and 10 CFR 50.34(f)(2)(xxvii) using the guidance of RG 1.97 and Appendix 11.5-A to SRP Section 11.5. This conclusion is supported by the reviews and evaluations conducted using the guidance in SRP Section 13.3 and SRP Chapter 7. The applicant has identified the specific revision of RG 1.97 applicable to the application, as described in SRP Chapter 7 and BTP 7-10. Supporting information on the staff's evaluation and findings of the applicant's information is presented in SER Chapter 7 and SER Sections 12.3-12.4, 12.5, and 13.3 and summarized here.

5. The review evaluated P&IDs, process flow diagrams, and descriptions of system proposed sampling points for the liquid, gaseous, and solid waste systems, provisions for local ventilation, and locations of monitoring and sampling points relative to effluent release points, as shown on site plot diagrams. The staff found the related information and description acceptable and consistent with NRC and industry guidance.

6. The staff reviewed the applicant's QA provisions for the PERMISS, the quality group and safety classifications used for system components, and the seismic design applied to structures housing these systems. As described by the applicant, the design of the systems and structures housing these systems has met the QA guidance of RG 1.143. The implementation of the guidance of RG 1.21, RG 1.33, RG 4.1, RG 4.8, 4.15, and RG1.143 provides reasonable assurance that the elements of the QA program are consistent with NRC guidance contained in GL 89-01; Radiological Assessment BTP (Revision 1, November 1979); and NUREG-1301 for PWRs or NUREG-1302 for BWRs and NUREG-0133 for either type of reactor.

7. The staff reviewed the provisions incorporated in the applicant's design to (1) control the release of radioactive materials in wastes and effluents caused by spills, leaks, and inadvertent tank overflows, (2) avoid the contamination of nonradioactive systems, (3) prevent uncontrolled and unmonitored releases of radioactive materials in the environment, and (4) avoid interconnections with potable and sanitary water systems. On the basis of this review, the staff concludes that the applicant's proposed measures are consistent with the guidance of RG 1.143 and RG 4.21 given the requirements of GDC 60 and 64 and 10 CFR 20.1406.

8. The staff concludes that the RETS/SREC, ODCM, and REMP describing administrative programs and operational procedures associated with their

implementation are consistent with the requirements of GL 89-01 and Radiological Assessment BTP (Revision 1, November 1979), and the guidance of NUREG-1301 for PWRs or NUREG-1302 for BWRs and NUREG-0133 for either type of reactor, and guidance of RG 1.21, RG 1.33, RG 4.1, RG 4.8, and RG 4.15.

9. If applicable, the staff has reviewed the proposed augmentation of programmatic elements in assessing the adequacy of the PERMISS design and resulting effects on the development of the RETS/SREC, ODCM, and REMP. The staff's evaluation and conclusion of the acceptability of the augmented programmatic elements is addressed in SER Section 13.4. Relevant requirements and guidance are identified in corresponding SER sections for systems and components described in the supplemental or new programmatic elements. The staff concludes that the proposed augmentation of programmatic elements is acceptable and consistent with the principles described in 10 CFR 20.1101(b) and 10 CFR Part 50, Appendix I design objectives and ALARA provisions

10. For liquid and gaseous process radiation monitoring equipment not covered by the ODCM, the review confirmed that the applicant has provided sufficient information describing methods and procedures that will be used in deriving lower limits of detection or detection sensitivities, and deriving set-points (alarms and process termination/diversion) for process radiation monitoring equipment. Similarly, the applicant has provided information describing a plant-specific process and radiological sampling and analysis plan for systems not covered by the ODCM. These provisions describe sampling and analytical frequencies, and radiological analyses for the expected types of liquid and gaseous samples and waste media generated by the LWMS, GWMS, and SWMS. The review confirmed that the proposed sampling and analytical frequencies and radiological analyses are commensurate with expected levels of radioactivity in associated systems.

11. The staff reviewed the sources of radiation and radioactivity and associated doses to members of the public and concludes that the total annual dose from all sources of radioactivity and radiation from the site, which may have either single or multiple units, including liquid and gaseous effluent discharges, external radiation exposures from buildings and storage tanks, and spent-fuel will not exceed the EPA generally applicable environmental radiation standards of 40 CFR Part 190, as implemented under 10 CFR 20.1301(e).

12. For sites with applicants and licensees operating two or more reactors, the staff confirmed that each applicant and licensee include in their respective ODCMs a process for notifying the other licensee to ensure that, when combined, effluent concentrations and offsite dose limits of 10 CFR Part 20 are not exceeded. The notification process includes the means by which releases of liquid and gaseous effluents can be coordinated and controlled such that all licensees are jointly aware of routine and planned releases, including those associated with AOOs as they occur. These arrangement between applicants and licensees provide reasonable assurance that effluent releases from two or more plants will not exceed the dose limits for members of the public under 10 CFR 20.1301 and 10 CFR 20.1302; 10 CFR 20.1301(e) in complying with 40 CFR Part 190; and liquid and gaseous

effluent concentration limits of 10 CFR Part 20, Appendix B, Table 2, Columns 1 and 2, and Note 4.

13. The applicant has met the requirements of 10 CFR 20.1406 with respect to providing a description of how the facility design and procedures for operation will minimize, to the extent practicable, contamination of the facility and the environment; facilitate eventual decommissioning; and minimize, to the extent practicable, the generation of radioactive waste. The review confirmed that the proposed design features of the PERMISS and implementing procedures comply with 10 CFR 20.1406 using the guidance of RG 1.143 and RG 4.21 and industry guidance of NEI 08-08A.

14. In accordance with the requirements of 10 CFR 50.65(a) and 10 CFR 50.65(b), using the guidance of RG 1.160, the applicant described the elements of a maintenance program and procedures that will used to monitor the performance or conditions of the PERMISS, including functions that are relied upon to monitor and mitigate accidents or transients or are used in plant EOPs. The information provides reasonable assurance that radiation monitoring and sampling equipment that are relied upon to mitigate accidents or transients or are used in plant EOPs are capable of fulfilling their intended functions.

15. The staff has reviewed the application and determined that the applicant has described the RETS/SREC, ODCM and REMP aspects of the process and effluent monitoring and sampling program and its implementation which is included in the license condition on operational programs and implementation. The applicant described the programs (Note: Staff to specify applicable operational program) and their implementation in conformance with SECY-05-0197 and 10 CFR 50.34a and 10 CFR 50.36a and 10 CFR 52.79(a). (For programs presented by the applicant as new programs or an augmentation of an existing program, the staff will add a statement indicating that the program(s) and its/their implementation milestones are included within the license condition on operational program implementation.)

For DC and COL reviews, the findings will summarize the staff's evaluation of requirements and restrictions (e.g., system interfaces and site parameters) in the referenced DC, discuss how COL action items relevant to this SRP section will be incorporated under plant- and site-specific conditions, and confirm that the applicant has met NRC requirements and guidance described in the application. For a COL, the findings will confirm that the applicant has addressed COL action items, requirements, and restrictions included in the referenced DC. The findings will confirm that plant design features of the certified design are maintained in the COL application and that the 10 CFR Part 52 process for seeking exemptions, changes, and departures will be observed in changing Tier 1, Tier 2, and Tier 2* information.

In instances where an applicant has submitted conceptual design information for portions of the plant for which the application does not seek certification, the findings will summarize the staff's evaluation in confirming that the applicant has submitted supplemental design details for the associated SSCs, adequately addressed system interfaces with other SSCs that are included in the DC, and determined the adequacy of the proposed ITAAC and methods used in verifying that all interface requirements have been met by the COL applicant under the requirements of 10 CFR 52.47(a)(24) to 52.47(a)(26), 10 CFR 52.79(d)(2), and 10 CFR 52.80(a). In addition, to

the extent that the review is not discussed in other SER sections, the findings will summarize the staff's evaluation of the ITAAC, including design acceptance criteria, as applicable

V. IMPLEMENTATION

The staff will use this section in performing safety evaluations of ESP, CP, DC, OL or COL applications submitted by applicants pursuant to 10 CFR Part 50 and 10 CFR Part 52. The staff will use the method described herein to evaluate conformance with Commission regulations as noted below. With respect to demonstrating conformance with the SRP, NRC regulations state, in part, that the application must contain "an evaluation of the standard plant design against the SRP revision in effect 6 months before the docket date of the application." However, an applicant is required to identify differences between this SRP section and design features, analytical techniques, and procedural measures proposed for the facility, and discuss how the proposed alternatives to the SRP acceptance criteria provide acceptable methods in complying with regulations that underlie SRP acceptance criteria and meet NRC regulatory requirements under 10 CFR 50.34(h), 10 CFR 52.17(a)(1)(xii), 10 CFR 52.47(a)(9), and 10 CFR 52.79(a)(41) for ESP, CP, DC, OL and COL applications.

VI. REFERENCES

1. American National Standards Institute, ANSI N42.18-2004, "Specification and Performance of On-Site Instrumentation for Continuously Monitoring Radioactivity in Effluents," 2004. ANSI standards are available at http://www.ANSI.org.

2. American National Standards Institute/American Nuclear Society, ANSI/ANS-40.37-2009, "American National Standard, Mobile Low-Level Radioactive Waste Processing Systems," 2009. Superseded ANSI/ANS-40.37-1993 in 2009. ANSI standards are available at http://www.ANSI.org.

3. American National Standards Institute/American Nuclear Society, ANSI/ANS-55.4-1993 (R2007), "Gaseous Radioactive Waste Processing Systems for Light Water Reactor Plants." Reaffirmed in 2007. ANSI standards are available at http://www.ANSI.org.

4. American National Standards Institute/American Nuclear Society, ANSI/ANS-55.6-1993 (R2007), "Liquid Radioactive Waste Processing System for Light Water Reactor Plants," Reaffirmed in 2007. ANSI standards are available at http://www.ANSI.org.

5. American National Standards Institute/Health Physics Society, ANSI/HPS N13.1-2011, "Sampling and Monitoring Releases of Airborne Radioactive Substances from the Stacks and Ducts of Nuclear Facilities." Approved March 30, 2011. ANSI standards are available at http://www.ANSI.org.

6. Electric Power Research Institute, EPRI Report 1013420, "Pressurized Water Reactor Primary Water Zinc Application Guidelines," 2006. EPRI reports are available at http://www.EPRI.com.

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11. Nuclear Energy Institute, NEI 07-07, “Industry Ground Water Protection Initiative – Final Guidance Document,” August 2007. NEI reports are available at http://www.NEI.org.

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13. Nuclear Energy Institute, NEI 08-08A, “Generic FSAR Template Guidance for Life Cycle Minimization of Contamination,” Revision 0, October 2009. ADAMS Accession No. ML093220530.

14. Nuclear Energy Institute, NEI 97-06, “Steam Generator Program Guidelines,” Revision 3, January 2011. ADAMS Accession No. ML111310712.

15. Technical Specifications Task Force, “TSTF-449: Steam Generator Tube Integrity,” Revision 4, April 14, 2005. ADAMS Accession No. ML051090200.

16. Technical Specifications Task Force, “TSTF-513: Revised PWR Operability Requirements and Actions for RCS Leakage Instrumentation,” Revision 1, February 18, 2009. ADAMS Accession No. ML101340271.

17. U.S. Code of Federal Regulations, “Standards for Protection Against Radiation,” Part 20, Chapter 1, Title 10, “Energy.”

18. U.S. Code of Federal Regulations, "Radiation Protection Programs," § 20.1101, Chapter 1, Title 10, "Energy.” (as it relates to ALARA provisions in controlling doses to members of the public.)

19. U.S. Code of Federal Regulations, "Radiation protection programs," § 20.1101(b), Chapter 1, Title 10, "Energy.” (as it relates to ALARA provisions in controlling doses to members of the public)

20. U.S. Code of Federal Regulations, "Occupational Dose Limits for Adults," § 20.1201, Chapter 1, Title 10, "Energy.”

21. U.S. Code of Federal Regulations, "Compliance with Requirements for Summation of External and Internal Doses," § 20.1202, Chapter 1, Title 10, "Energy.”

22. U.S. Code of Federal Regulations, "Dose Limits for Individual Members of the Public," § 20.1301, Chapter 1, Title 10, "Energy."

23. U.S. Code of Federal Regulations, "Dose limits for individual members of the public," § 20.1301(e), Chapter 1, Title 10, "Energy." (as it relates to compliance with the EPA's 40 CFR Part 190 generally applicable environmental radiation standards for facilities within the nuclear fuel cycle.)

24. U.S. Code of Federal Regulations, "Compliance with Dose Limits for Individual Members of the Public," § 20.1302, Chapter 1, Title 10, "Energy."

25. U.S. Code of Federal Regulations, "Minimization of Contamination," § 20.1406, Chapter 1, Title 10, "Energy."

26. U.S. Code of Federal Regulations, "General," § 20.1501, Chapter 1, Title 10, "Energy." (as it relates to the conduct of radiation surveys and monitoring.)

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Table 1: Provisions for Monitoring and Sampling Gaseous Process and Waste Streams (*)

No.	Process Systems(**)	In Process Conti	In Effluent ACFj	In Effluent Conti	In Process Grabk	In Effluent Grabk	Contl
1.	Waste Offgas Holdup System[a]	NG	NG	(NG)		(NG,H3)	(1)
2	Condenser Evacuation System[b]	NG	(NG)	(NG)	I	(NG,H3)	(I)
3.	Building Vent and Stack Release Point and Systems[c]	–	–	NG		H3	(I)
4.	Containment Purge Systems and Isolation Condenser Exhaust Systems[d]	NG	NGm	(NG)	I	(NG,I,H3)	(I)
5.	Auxiliary or Service Building System	_	_	(NG)	I	(NG,H3)	(I)
6.	Fuel Storage Area Ventilation System[e]	(NG)	NGm	(NG)	I	(NG,H3)	(I)
7.	Radwaste Area Vent Systems	_	_	(NG)	I	(NG,H3)	(I)
8.	Turbine Gland Seal Condenser Vent System	_	_	(NG)	I	(NG,H3)	(I)
9.	Mechanical Vacuum Pump Exhaust(Hogging System)	_	_	(NG)	I	(NG,H3)	(I)
10.	Evaporator Vent Systems	_	_	(NG)	I	(NG,H3)	(I)
11.	Vents from Liquid Radwaste Tanks and Components	_	_	(NG)	(I)	(NG,H3)	(I)
12.	Steam Generator Systems and Generator Blowdown and Degasifier Systems Treatment Systems	_	_	(NG)	I	(NG,H3)	(I)
13.	Turbine Building Vent Systems	_	_	(NG)	I	(NG,H3)	(I)
14.	Pressurizer and Boron Recovery Vent Systems	_	_	(NG)	I	(NG,H3)	(I)
15.	Ventilation from Waste Compactors, Shredders, Etc.(as Permanently Installed or Mobile Systems)	R	–	I	I	I	(I)
16.	Exhausts from compressed air and instrument air systems with potential for radioactive contamination	R	–	I	I	I	(I)

(*) For the key to legend, see the notes on the page following Table 2.
(**) The listing is not considered to be all inclusive. Applicant should identify process and effluent systems that are unique to the specific type of reactor technology described in the application.

Table 2: Provisions for Monitoring and Sampling Liquid Process and Waste Streams (*)

No.	Process Systems(**)	Monitor Provisions			Sample Provisions		
		In Process	In Effluent		In Process	In Effluent	
		Cont[i]	ACF[j]	Cont[i]	Grab[k]	Grab[k]	Cont[i]
1.	Liquid Radwaste (Batch) Treatment and Effluent System	(R)	R[m]	R	S&A	S&A,H3	—
2.	Liquid Radwaste (Continuous) Treatment and Effluent System	R	R[m]	R	—	S&A,H3	S&A
3.	Service Water System, Circulating Water System, Turbine Cooling Water System, Seal Water Supply System, Demineralized. Water Makeup System, Safety Chilled Water System, Isolation Condenser Systems, etc. (As systems with potential for radioactive cross-contamination)	—	—	(R)	—	S&A,H3	S&A
4.	Component Cooling Water System [f]	(R)	(R[m])	(R)	S&A	S&A,H3	(S&A)
5.	Spent Fuel Pool Treatment System [g]	(R)	(R)	(R)	S&A	(S&A,H3)	(S&A)
6.	Equipment and Floor Drain Collection and Treatment Systems [h]	—	(R)	(R)	—	(S&A,H3)	(S&A)
7.	Phase Separator Decant & Holding Basin Systems	—	(R)	(R)	—	(S&A,H3)	(S&A)
8.	Chemical and Regeneration Solution Waste Systems	—	(R)	(R)	—	(S&A,H3)	(S&A)
9.	Laboratory and Sample Drain System and Laboratory Floor Drains	—	(R)	(R)	S&A	(S&A,H3)	(S&A)
10.	Laundry and Decontamination Waste Systems and Drains	—	(R)	(R)	—	(S&A,H3)	(S&A)
11.	Resin Slurry, Solidification, & Drain Systems	(R)	—	(R)	—	(S&A,H3)	(S&A)
12.	Radwaste Liquid Tanks (outside of buildings)	—	—	(R)	S&A	(S&A,H3)	—
13.	Site storm & Underdrain Water	—	—	—	—	(S&A,H3)	(S&A)

	Systems						
14.	Tanks and Sumps Inside Reactor Building	—	(R)	(R)	—	(S&A,H3)	(S&A)
15.	Coolant Purification System and Boron Recovery System (as associated with process treatment and liquid effluents)	—	(R)	(R)	—	(S&A,H3)	(S&A)
16.	Steam Generator Blowdown (Batch) Liquid Effluent and Treatment Systems	(R)	R	R	S&A	(S&A,H3)	(S&A)
17.	Steam Generator Blowdown (Continuous) and Treatment Systems	(R)	R^m	R	—	(S&A,H3)	(S&A)
18.	Secondary Coolant Treatment Waste and Turbine Building Drain Systems	—	(R)	(R)	—	(S&A,H3)	(S&A)
20.	Noncontaminated Wastewater, Sanitary Wastes, PWR Turbine Building Clean Drain System, Cooling Tower or Impoundment Blowdown, etc.	—	—	—	—	(S&A,H3)	(S&A)
21.	Other process and effluent treatment systems, (e.g., reverse osmosis, ultra-filtration, centrifugal separation), etc.	R	R	R	S&A	S&A,H3	S&A
22.	Mobile Liquid and Wet Waste Processing Systems (as described in application)	R	R	R	S&A	S&A,H3	S&A
23.	Reactor coolant pressure boundary and steam generator tube TS leakage rate monitoring systems	R1	--	R1	S&A	--	--

(*) For the key to the legend, see the notes on the next page.
(**) The listing is not considered to be all inclusive. Applicant should identify process and effluent systems that are unique to the specific type of reactor technology described in the application.

Notes for Table 1 and Table 2

a. For example, offgas storage tank systems, cover gas decay systems, chilled charcoal adsorption systems, offgas cryogenic units, and noble gas delay beds and tanks.

b. For example, main condenser steam jet air ejector systems and mechanical vacuum pump systems.

c. For example, free standing stacks, roof vents, building vents, system exhausters, process vents, ventilation vents, and portable local exhaust ventilation systems.

d. For example, containment relief systems, containment normal purge, containment low-volume purge, containment leak testing systems, drywell purge, cleanup purges.

e. Includes spent fuel pool and refueling pool ventilation systems, if separate from the fuel storage area ventilation system.

f. Also called closed cooling water systems and component cooling loop systems.

g. Includes refueling pool cleanup systems.

h. Includes suppression tanks, reactor drain tanks, equipment and drain sumps collecting leakage, drainage, sampling, and condensate.

i. Continuous radiation monitor.

j. Automatic control feature. For example, the continuous liquid effluent radiation monitor (see note m, below) should be equipped to alarm at a setpoint established in the RETS/SREC and ODCM and should automatically terminate effluents in the discharge line by closing an isolation valve (see SRP Acceptance Criterion 3.D and Technical Rationale Item 6 and note “m” below).

k. Sample point should be available to obtain grab samples for laboratory analyses as indicated by notations or for the purpose of confirming the results of continuous radiation monitoring.

l. Continuous sampler (see SRP Acceptance Criterion 1.B).

m. The automatic control feature may be alternatively provided by a process continuous radiation monitor located at a point upstream of the systems’ effluent continuous radiation monitor to ensure the timely closure of the isolation valve/damper to avoid exceeding discharge limits. If part of the design, controls in monitoring deviations of in-plant dilution and exhaust flow rates in terminating releases or isolating process flows when deviations exceed preset limits. Other considerations may include determining whether system logic demands that a valve or damper fail in the closed position in protecting the system from further contamination, terminating releases to the environment, or diverting process streams or effluents to appropriate treatment systems. Acceptable guidance is presented in this SRP section and ANS N42.18-2004. These provisions also apply to liquid and gaseous process radiation monitoring equipment not covered by the ODCM.

NG - Noble gas radioactivity, such as argon, krypton, and xenon gases.

I - Iodine radioactivity, radioactivity of other radionuclides in particulate and gaseous form (e.g., carbon-14), and alpha emitters.

H3 - Tritium as tritiated water and water vapors, and elemental and organic forms.

R - Gross radioactivity (beta radiation, gamma radiation, or total beta plus gamma). This provision also applies to measurement methods relying on the use of surrogate radionuclides, as easy-to-detect, in accounting for the presence of hard-to-detect radionuclides when not specifically analyzed or monitored.

R1 - For instrumentation used to comply with TS on reactor coolant pressure boundary (RCPB) or steam generator (SG) tube leakage rates, the basis of the placement of the radiation detectors on system piping and components and detection sensitivity of the radiation monitoring system should be described and specify which radionuclides are used to demonstrate conformance with the TS.

S&A - Sampling and analysis of radionuclides, to include gross radioactivity, identification and concentration of principal or significant radionuclides, and concentration of alpha emitters, as defined in the RETS/SREC and ODCM using NRC guidance. This provision applies to liquid and gaseous process radiation monitoring equipment not covered by the ODCM, including information describing a plant-specific process, TS for RCPB and SG tube leakage rates, and radiological sampling and analysis plan for systems not covered by the ODCM.

( ) - Monitoring or sampling provisions indicated within parentheses are required only for systems not monitored, sampled, or analyzed (as indicated) prior to release.

APPENDIX 11.5-A

DESIGN GUIDANCE FOR RADIOLOGICAL EFFLUENT MONITORS PROVIDING SIGNALS FOR INITIATING TERMINATION OF FLOW OR OTHER MODIFICATION OF EFFLUENT STREAM PROPERTIES

1. Background

The primary design function of a radiological effluent monitor is the detection and measurement of radioactive materials released in gaseous or liquid effluent streams of light-water-cooled nuclear power reactors. An additional design function of some monitors is to provide a signal to automatically terminate or otherwise modify the effluent stream. Examples of this function are the termination of exhaust airflow by closure of containment ventilation or purge isolation valves and diversion of building ventilation exhaust streams from an untreated discharge path to an alternative treatment system using high-efficiency particulate air and charcoal filters.

Depending on plant design and onsite meteorology, such an action may be necessary to mitigate the consequences of a design-basis accident (DBA). The need for such mitigation is determined by calculating the offsite doses that would result from the DBA. In other plant designs, radiological effluent monitors are used to actuate systems to modify or terminate releases for other purposes (e.g., to terminate releases from AOOs occurrences to ensure that offsite doses are maintained within the limits specified in the plant TS and RETS or SREC and ODCM.

The design and QA criteria applied to the design, procurement, installation, testing, and operation of radiological effluent monitors installed in light-water-cooled nuclear power reactors should provide reasonable assurance that the monitors will perform all of their design safety functions using the guidance of SRP Chapter 7, SRP BTP 7-10, SRP Chapter 13, and RG 1.97 for safety-related systems and RG 1.143, and industry guidance for nonsafety-related systems.

If the DBA analysis indicates that the actuation of an ESF system is required to mitigate the consequences of a DBA and a signal from a radiological effluent monitor is necessary to actuate the ESF system, then the monitor should be designed and qualified to the design and QA criteria applicable to the ESF system. Conversely, if an automatically functioning device or system is used to reduce radioactive releases to ensure that offsite doses are maintained within the limits of the plant's RETS/SREC (i.e., not for the purpose of mitigating the consequences of a DBA), then a monitor providing the actuation signal should be designed and qualified to criteria consistent with those of the actuated system, such as those that are important to safety and used to comply with the requirements of 10 CFR Part 20 in protecting plant workers and members of the public.

For nonsafety-related systems, the review of interfaces of radiation monitoring instrumentation and controls, including provisions for automatic control features and interdependence with other plant system parameters (e.g., fluid level, valve position, and system pressure, flow rate, and temperature), is performed using the guidance presented in this SRP section. Other considerations may include determining whether a system's functional logic demands that a valve or damper fail in the closed position in protecting the system from further contamination, terminating releases to the environment, or diverting process streams or effluents to

appropriate treatment systems. Acceptable guidance is presented in SRP Section 11.5 and ANS N42.18-2004. The review addresses the types and placement of radiation detectors in plant systems, operational ranges and qualification of detectors in supporting the functions of radiation monitoring systems, functional interdependence and logic in alarming and terminating or diverting process or effluent streams. The review addresses the use and derivation of alarm setpoints in notifying control room operators and initiating automatic control functions in complying with doses for workers, members of the public, and effluent concentration limits under 10 CFR Part 20, and design objectives of Appendix I to 10 CFR Part 50. The review considers design features used to prevent the radioactive contamination of otherwise nonradioactive plant systems, and in avoiding unmonitored and uncontrolled releases of radioactive materials in the environment.

This appendix neither establishes, nor changes in any manner, the design and QA criteria established elsewhere for ESF or ESF-related systems or monitors.

The design guidance set forth in this appendix provides reasonable assurance that monitors used to provide initiation signals for actuation of systems to control the release of radioactive materials in effluents, but not required to mitigate the consequences of a DBA, are designed, constructed, installed, tested, and maintained on a level commensurate with their intended safety function.

This appendix sets forth minimum requirements and is not intended to prohibit the implementation of equivalent design codes, standards, or QA measures other than those indicated herein.

2. Definitions

Radiological Effluent Monitor: A device that removes a representative sample from the effluent stream, detects and quantitatively measures the radioactive materials present in the sample, discharges the sampled medium back to the effluent stream, and transmits the measurement data to a central point. Some monitoring systems instead rely on the placement of a radiation detector near or within the effluent streams in achieving the same function without diverting any portion of the effluent stream.

Monitoring System: A system consisting of one or more remote monitors; a centrally located cabinet or console where data from the monitors are received, recorded, converted to meaningful radiological units, and displayed; and the necessary interconnecting cables, power supplies, pumps, motors, alarms, recorders, display panels, and other auxiliary components.

Automatic Control Feature: A design feature that automatically initiates a control or protective action when exceeding a defined instrumentation alarm set-point. The set point may represent radioactivity concentration levels and release rates, or signals other than radioactivity (e.g., fluid level, valve position, and system pressure, flow rate, and temperature). The initiation of control or protective actions may rely only the presence of radioactivity or be linked to the status other plant system parameters as functional interdependence and logic in alarming and terminating or diverting process or effluent streams. Other considerations may include determining whether system logic demands that a valve or damper fail in the closed position in protecting the system from further contamination, terminating releases to the environment, or diverting process streams or effluents to appropriate treatment systems. These provisions also apply to liquid and gaseous process radiation monitoring equipment not covered by the ODCM.

3. Design Guidance

Design and QA criteria for radiological effluent monitors should be consistent with the design and QA criteria applicable to the systems actuated by a signal from the monitors.

Monitors providing signals for the actuation of ESF systems should be designed and qualified to the design and QA criteria applicable to ESF systems. Criteria for ESF-related monitors are found in the appropriate sections of SRP Chapter 7. This position does not affect or modify existing criteria for ESF-related systems.

Monitors providing signals for the actuation of non-engineered safety feature systems should be designed and qualified to the design and QA criteria applicable to the actuated system or to the criteria shown in Table 1 of this appendix and guidance of this SRP section.

4. Implementation

This section provides information to applicants and licensees regarding the staff's plans for using this appendix.

Except in those cases in which the applicant proposes an alternate method for complying with specified portions of the Commission's regulations, the criteria described herein will be used to evaluate applications for construction permits, operating licenses, and applications for standard DCs and COLs.

These criteria do not apply to operating plants with established licensing basis on the above considerations.

APPENDIX 11.5-A
TABLE 1

Design Guidance for Radiological Effluent Monitors
(Instrumentation Installed in Light-Water-Cooled Nuclear Power Plants)

Category	Design Criteria	Quality Assurance Criteria, and Quality Group and Safety Classifications
Effluent radiological monitoring instrumentation providing a signal for the actuation of a system used to control or reduce releases of radioactive materials in effluents within limits specified in plant RETS/SREC. Provisions may be used in protecting nonradioactive systems from being contaminated by bypasses and backflows across systems. (Not required to initiate actuation for an ESF system. For safety-related systems, see SRP Chapter 7 and BTP 7-10 and RG 1.97 for guidance.)	Review: Reviewed using the guidance in SRP Section 11.5	Review: Reviewed using the guidance in SRP Section 11.5 and SRP Chapter 13 and 17.
	Reviewed by: 1, 2, 3, & 4.	Reviewed by: 2, 3, 4, and 5.
	Criteria: Manufacturer's per ANSI N42-18-2004 and other applicable industry standards. Criteria: Quality assurance set forth in RG 1.143 and industry standards. Safety Classification: RG 1.143, regulatory positions in protecting PERMISS system and equipment interfaces with RWMS against natural phenomena and man-induced hazards.	Reviewed by: 1,2, 3, and 5 Reviewed by: 1,2, 3, and 5 Reviewed by: 1,2, 3, and 6.

Notes:

1. Organization responsible for the review and assessment of the performance of the process and effluent radiological instrumentation and sampling systems and associated RETS or SREC, including the Offsite Dose Calculation Manual or Process Control Program.

2. Organization responsible for the review of system specifications and plant systems interface elements of the process and effluent radiological instrumentation and sampling systems, including system functional performance.

3. Organization responsible for the review of the instrumentation and controls elements of the process and effluent radiological instrumentation and sampling systems, including system functional performance.

4. Organization responsible for the review of emergency planning.

5. Organization responsible for the review of quality assurance.

6. Organizations responsible for the reviews of SSCs quality group and safety classifications under SRP Sections 3.2, and 11.2 to 11.5 using the guidance of RG 1.143.

PAPERWORK REDUCTION ACT STATEMENT

The information collections contained in the Standard Review Plan are covered by the requirements of 10 CFR Parts 20, 50, and 100, and were approved by the Office of Management and Budget, approval numbers 3150-0014, 3150-0011, 3150-0151, and 3150-0093.

PUBLIC PROTECTION NOTIFICATION

The NRC may not conduct or sponsor, and a person is not required to respond to, a request for information or an information collection requirement unless the requesting document displays a currently valid OMB control number.

SRP Section 11.5
Description of Changes

Section 11.5 "Process and Effluent Radiological Monitoring Instrumentation and Sampling Systems"

This SRP section affirms the technical accuracy and adequacy of the guidance previously provided in Section 11.5, Revision 5, dated May 2010, of this SRP. See ADAMS Accession No. ML100740509. Editorial changes included adding new abbreviations in several places throughout this section and correcting grammatical errors. Other changes reflect the removal of redundant information.

Technical changes incorporated in this revision include:

I. AREAS OF REVIEW

The areas of review section was revised by identifying additional technical areas which warrant staff evaluation in assessing the design and performance characteristics of the PERMISS in recognition of existing guidance and regulatory requirements. In part, the additional technical topics identified here also support the expanded topics listed in review interfaces. The additional areas of review address:

1. Expanded discussions on design features to prevent, control, and collect radioactive materials, as condensate, from building ventilation systems and ductwork, and gases vented from tanks and components. The discussions also refer to the guidance of RG 1.54 and RG 4.21 and industry guidance under NEI 08-08A in meeting the requirements of 10 CFR 20.1406.

2. Expanded discussion on processing systems equipped with automatic control features, justification for the placement of isolation dampers/valves and radiation detectors on process piping, ductwork, and effluent discharge lines to ensure their timely closure upon the detection of elevated radioactivity levels, and, if part of the design, controls in monitoring deviations of exhaust flow rates and terminating releases or isolating process flows when deviations exceed preset limits.

3. Expanded discussions on radiological monitoring instrumentation classified as safety-related functions and instances when such instrumentation may perform complementary roles, such as used to comply with the requirements of 10 CFR Part 20 and 10 CFR Part 50 during normal operations and TMI-related requirements. The discussion addresses monitoring instrumentation and performance criteria of RG 1.97 and BTP 7-10 in confirming that such instrumentation can provide complementary functions in monitoring radiological conditions during normal operations and AOOs.

4. Expanded discussion on quality assurance provisions given the guidance of RG 1.143 for PERMISS subsystem interfaces with RWMS components not covered by the requirements of 10 CFR Part 50, Appendix B.

5. Expanded discussions on design features used for purging and flushing sampling lines and monitors with nonradioactive fluids (e.g., clean water, air, inert gases) and routing

purged or flushed fluids to the LWMS and GWMS. The discussion addresses confirmation that sources of nonradioactive purging or flushing fluid is protected from backflow and radioactive cross-contamination by using appropriate measures, such as check valves, backflow preventers, interlocks, differential pressures, etc., with the means to return samples from process and effluents streams to their origins.

6. Expanded discussions on 10 CFR Part 50, Appendix A, GDC 2 and 61, as they relate to acceptance criteria related to seismic, safety, and quality group classifications for RWMS SSCs and interface with PERMISS using the guidance of RG 1.143.

7. Expanded listing of plant systems identified in review interfaces has been expanded to ensure that the staff's review of radiological considerations is properly integrated with parallel and complementary evaluations conducted by other technical disciplines. For systems that contribute potential input wastes to process streams and effluents monitored by the PERMISS, the following SRP chapters and sections were identified with technical and regulatory interfaces. The SRP Chapters and Sections are 1.8, 1.9, 2.1.2, 5.2.5, 5.2.4, 5.4.6, 5.4.8, 5.4.13, 6.5, 7.1, 7.6, 7.7, 9.1.2, 9.1.3, 9.2.3, 9.2.4, 9.2.6, 9.3.1, 9.3.3, 9.3.4, 9.4, 9.5.1, 10.4, 11.1, 13.5, 14.2, 14.3, and 17, and associated BTPs as noted in each SRP section.

II. ACCEPTANCE CRITERIA

The acceptance criteria section was revised by including citations of existing regulatory requirements not cited in the prior SRP and providing clarification on methods used in monitoring and sampling process and effluent streams in demonstrating compliance with 10 CFR Part 20 and 10 CFR Part 50, Appendix I. The major revisions include:

1. Addition of a discussion on 10 CFR 20.1101(b), as it relates to the use of procedures and engineering controls in maintaining doses to members of the public ALARA.

2. Addition of a discussion on 10 CFR 20.1501, as it relates to the conduct of radiation surveys in monitoring the presence of radioactivity in RWMS and in process and effluent streams.

3. Addition of a discussion on 10 CFR Part 50, Appendix A, GDC 2, as it relates to the design basis of structures housing PERMISS and its components using the guidance of RG 1.143 in assigning safety classifications to RWMS with PERMISS interfaces.

4. Addition of a discussion on 10 CFR Part 50, Appendix A, GDC 19, as it relates to actuation of systems that permit access and occupancy of the control room under accident conditions without personnel receiving radiation exposures in excess of 5 rem (TEDE) for the duration of the accident.

5. Addition of a discussion on 10 CFR 50.65(a) and 50.65(b) as they relate to providing reasonable assurance that SSCs important to safety, including those that are relied upon to mitigate accidents or transients or are used in plant EOPs (i.e., radiation monitors described in this SRP, or radiation protection features described in SRP Sections 12.3-12.4) and SRP Section 12.5 are capable of fulfilling their intended functions.

6. Addition of a discussion on 10 CFR Part 50, Appendix B, Sections XI and XII, as they relate to programs and procedures for the control of measuring and test equipment as it applies to radiation monitoring and sampling instrumentation for systems not covered by the QA guidance of RG 1.143.

7. Addition of a discussion on 40 CFR Part 190 (EPA generally applicable environmental radiation standards), as implemented under 10 CFR 20.1301(e), as it relates to limits on annual doses from all sources of radioactivity contained in liquid and gaseous effluent discharges and external radiation from site buildings and facilities (with single or multiple reactor units). The guidance has been expanded in evaluating compliance with the standards for sites that have site-specific information on the locations of offsite dose receptors and those that do not.

8. Clarifications for sites with applicants and licensees operating two or more reactors, the staff's review would confirm that applicant and licensee include in their respective ODCM a process for notifying the other licensee on the same site to ensure that, when combined, effluent concentrations and offsite dose limits of 10 CFR Part 20 are not exceeded. The notification process would include the means by which releases of liquid and gaseous effluents can be coordinated and controlled such that all licensees on the site are jointly aware of routine and planned releases, including those associated with AOOs as they occur.

9. Additional clarification is provided on the use of automatic control features and placement of isolation valves and dampers and radiation detectors on process piping, ductwork, and effluent vents and stacks to ensure their timely closure upon the detection of elevated radioactivity levels, and, if part of the design, controls in monitoring deviations in exhaust flow rates in terminating releases or isolating process flows when deviations exceed preset limits. Other considerations include determining whether system logic demands that a valve or damper fail in the closed position in protecting the system from further contamination, terminating releases to the environment, or diverting process streams or effluents to appropriate treatment systems.

10. Clarification on guidance in reviewing proposed technical resolution of USIs and medium- and high-priority GSIs identified in the version of NUREG-0933 current on the date 6 months before the submission of the application as technically relevant to the design; how operating experience insights have been incorporated into the plant design; and information necessary to demonstrate compliance with technically relevant portions of the TMI requirements.

11. An updated listing of NRC and industry guidance reflecting operating experience – see updated reference list below.

12. Addition of specific references added in recognizing industry guidance on steam generator program and guidance on secondary coolant chemistry and steam generator tube integrity. Similarly, a reference was added to address operability requirements and actions for RCS leakage detection and instrumentation.

13. Addition of a discussion on SRP guidance endorsing NEI 08-08A, "Generic FSAR Template Guidance for Life Cycle Minimization of Contamination," (Revision 0,

October 2009) in describing acceptable methods in complying with 10 CFR 20.1406 and guidance of RG 4.21.

14. Addition of a discussion on SRP guidance endorses NEI 07-09A, "Generic FSAR Template Guidance for Offsite Dose Calculation Manual (ODCM) Program Description," (Revision 0, March 2009) as an acceptable commitment in developing a plant and site-specific ODCM before fuel load, as specified in SRP Sections 11.5 and 13.4.

III. REVIEW PROCEDURES

The review procedures section was updated in recognition of the revisions identified in the areas of review and acceptance criteria sections, as noted in explanations above.

IV. EVALUATION FINDINGS

The evaluation findings section was revised by expanding the discussions on the results of the staff's evaluation and conclusion of acceptability against cited regulations and guidance. The revisions address:

1. 10 CFR Part 50, Appendix A, GDC 2 and GDC 61, as they relate to acceptance criteria related to seismic, safety, and quality group classifications and quality assurance provisions for PERMISS component interfaces with RWMS process equipment, using the guidance of RG 1.143

2. If applicable, proposed augmentation of programmatic elements in assessing the adequacy of the design and development of PERMISS monitoring and sampling equipment in demonstrating compliance with 10 CFR Part 20 effluent concentration and dose limits and 10 CFR Part 50, Appendix I design objectives and ALARA provisions.

3. Confirmation that the applicant has committed, as an option, to develop a plant and site-specific ODCM before fuel load, based on NEI ODCM Template 07-09A.

4. Expanded discussion in determining compliance with the EPA generally applicable environmental radiation standards of 40 CFR Part 190, as implemented under 10 CFR 20.1301(e).

5. For sites with applicants and licensees operating two or more reactors, the evaluation findings address whether applicants and licensees have included in their respective ODCMs a process for notifying the other licensee in coordinating effluent releases to ensure that, when combined, effluent concentrations and offsite dose limits of 10 CFR Part 20 are not exceeded at a common dose receptor location.

V. IMPLEMENTATION

The implementation section was revised by expanding the discussions on the evaluation of ESP, DC, COL applications. The expanded discussion address differences between standard plant design features, COL applications, and SRP acceptance criteria, and provide guidance on the acceptability of alternative methods in complying with cited regulations and SRP acceptance criteria.

VI. REFERENCES

The following references were added in support of the expanded discussions presented in areas of review, acceptance criteria, and review procedures. The added references are:

1. American National Standards Institute/American Nuclear Society, ANSI/ANS-40.37-2009, "American National Standard, Mobile Low-Level Radioactive Waste Processing Systems," 2009. Superseded ANSI/ANS-40.37-1993 in 2009. ANSI standards are available at http://www.ANSI.org.

2. American National Standards Institute/American Nuclear Society, ANSI/ANS-55.4-1993 (R2007), "Gaseous Radioactive Waste Processing Systems for Light Water Reactor Plants." Reaffirmed in 2007. ANSI standards are available at http://www.ANSI.org.

3. American National Standards Institute/American Nuclear Society, ANSI/ANS-55.6-1993 (R2007), "Liquid Radioactive Waste Processing System for Light Water Reactor Plants." Reaffirmed in 2007. ANSI standards are available at http://www.ANSI.org.

4. Electric Power Research Institute, EPRI Report 1013420, "Pressurized Water Reactor Primary Water Zinc Application Guidelines," 2006. EPRI reports are available at http://www.EPRI.com.

5. Electric Power Research Institute, EPRI Report 1008219, "PWR Primary-to-Secondary Leak Guidelines: Revision 3," December 2004. EPRI reports are available at http://www.EPRI.com.

6. Electric Power Research Institute, EPRI Report 1008224, "PWR Secondary Water Chemistry Guidelines: Draft Revision 6," December 2004. EPRI reports are available at http://www.EPRI.com.

7. Institute of Electrical and Electronics Engineers, IEEE Standard 497-2002, "IEEE Standard Criteria for Accident Monitoring Instrumentation for Nuclear Power Generating Stations." IEEE standards are available at http://www.IEEE.org.

8. Institute of Electrical and Electronics Engineers, IEEE Standard 603-1991, "IEEE Standard Criteria for Safety Systems for Nuclear Power Generating Stations." IEEE standards are available at http://www.IEEE.org.

9. Nuclear Energy Institute, NEI 07-07, "Industry Ground Water Protection Initiative – Final Guidance Document," August 2007. NEI reports are available at http://www.NEI.org.

10. Nuclear Energy Institute, NEI 07-09A, "Generic FSAR Template Guidance for Offsite Dose Calculation Manual (ODCM) Program Description," Revision 0, March 2009. ADAMS Accession No. ML083530745.

11. Nuclear Energy Institute, NEI 08-08A, "Generic FSAR Template Guidance for Life Cycle Minimization of Contamination," Revision 0, October 2009. ADAMS Accession No. ML093220530.

12. Nuclear Energy Institute, NEI 97-06, “Steam Generator Program Guidelines,” Revision 3, January 2011. ADAMS Accession No. ML111310712.

13. Technical Specifications Task Force, “TSTF-449: Steam Generator Tube Integrity,” Revision 4, April 14, 2005. ADAMS Accession No. ML051090200.

14. Technical Specifications Task Force, “TSTF-513: Revised PWR Operability Requirements and Actions for RCS Leakage Instrumentation,” Revision 1, February 18, 2009. ADAMS Accession No. ML101340271.

15. U.S. Code of Federal Regulations, "Radiation protection programs," § 20.1101(b), Chapter 1, Title 10, "Energy.” (as it relates to ALARA provisions in controlling doses to members of the public)

16. U.S. Code of Federal Regulations, "Dose limits for individual members of the public," § 20.1301(e), Chapter 1, Title 10, "Energy.” (as it relates to compliance with the EPA’s 40 CFR Part 190 generally applicable environmental radiation standards for facilities within the nuclear fuel cycle.)

17. U.S. Code of Federal Regulations, "General," § 20.1501, Chapter 1, Title 10, "Energy.” (as it relates to the conduct of radiation surveys and monitoring.)

18. U.S. Code of Federal Regulations, “Contents of Applications; Technical Information,”§ 50.34, Chapter 1, Title 10, “Energy.” (as it relates to the means for controlling and monitoring releases of radioactive materials expected during operations, AOOs, and accident conditions in compliance with the limits of 10 CFR § 20.1301 and 10 CFR § 20.1302 for members of the public).

19. U.S. Code of Federal Regulations, "Additional TMI-Related Requirements," § 50.34(f), Chapter 1, Title 10, "Energy.” (§§ 50.34(f)(2)(viii), 50.34(f)(2)(xiv)(E), 50.34(f)(2)(xvii), 50.34(f)(2)(xxvi), and 50.34(f)(2)(xxvii), under “Additional TMI-Related Requirements” as they relate to provisions in monitoring, sampling, and terminating effluent releases under accident conditions.)

20. U.S. Code of Federal Regulations, “Design Objectives for Equipment to Control Releases of Radioactive Material in Effluents in Nuclear Power Reactors,” § 50.34a, Chapter 1, Title 10, “Energy.”

21. U.S. Code of Federal Regulations, "Technical Specifications on Effluents from Nuclear Power Reactors," § 50.36a, Chapter 1, Title 10, "Energy.”

22. U.S. Code of Federal Regulations, "Changes, Tests, and Experiments," § 50.59, Chapter 1, Title 10, "Energy.”

23. U.S. Code of Federal Regulations, "Requirements for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants," § 50.65, Chapter 1, Title 10, "Energy.”

24. U.S. Code of Federal Regulations, “Domestic Licensing of Production and Utilization,” Part 50, Chapter 1, Title 10, “Energy,” Appendix A, “General Design Criteria for Nuclear Power Plants,” General Design Criterion 19, “Control Room.”

25. U.S. Code of Federal Regulations, “Domestic Licensing of Production and Utilization,” Part 50, Chapter 1, Title 10, “Energy,” Appendix A, “General Design Criteria for Nuclear Power Plants,” General Design Criterion 2, “Design bases for protection against natural phenomena.”

26. U.S. Code of Federal Regulations, “Domestic Licensing of Production and Utilization,” Part 50, Chapter 1, Title 10, “Energy,” Appendix B, “Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants.” (in so far as it applies to RWMS and PERMISS systems and components not covered by the QA guidance of RG 1.143.)

27. U.S. Nuclear Regulatory Commission, Circular No. 77-14, “Separation of Contaminated Water Systems from Uncontaminated Plant Systems,” November 22, 1977.

28. U.S. Nuclear Regulatory Commission, Information Notice 79-09, “Spill of Radioactively Contaminated Resins,” March 30, 1979.

29. U.S. Nuclear Regulatory Commission, Information Notice 86-42, “Improper Maintenance of Radiation Monitoring Systems,” June 9, 1986.

30. U.S. Nuclear Regulatory Commission, Information Notice 2004-05, “Spent Fuel Pool Leakage to Onsite Groundwater,” March 3, 2004. ADAMS Accession No. ML040580454.

31. U.S. Nuclear Regulatory Commission, Information Notice 2005-24, “Nonconservatism Information Notice Leakage Detection Sensitivity,” August 3, 2005. ADAMS Accession No. ML051780073.

32. U.S. Nuclear Regulatory Commission, Information Notice 2006-13, “Ground-Water Contamination Due to Undetected Leakage of Radioactive,” July 10, 2006. ADAMS Accession No. ML060540038.

33. U.S. Nuclear Regulatory Commission, Information Notice 2012-05, “Abnormal Releases of Radioactive Water Potentially Resulting Information Notice Groundwater Contamination,” April 25, 2012. ADAMS Accession No. ML120410213.

34. U.S. Nuclear Regulatory Commission, NUREG/CR-4013, “LADTAP II – Technical Reference and User Guide,” April 1986.

35. U.S. Nuclear Regulatory Commission, NUREG/CR-4653, “GASPAR II – Technical Reference and User Guide,” March 1987.

36. U.S. Nuclear Regulatory Commission, NUREG-0543, “Methods for Demonstrating LWR Compliance With the EPA Uranium Fuel Cycle Standard (40 CFR Part 190).” February 1980. ADAMS Accession No. ML081360410.

37. U.S. Nuclear Regulatory Commission, NUREG-0800, Section 5, BTP 5-1 “Monitoring of Secondary Side Water Chemistry in PWR Steam Generators.” ADAMS Accession No. ML070850019.

38. U.S. Nuclear Regulatory Commission, NUREG-00933, “Resolution of Generic Safety Issues (Formerly entitled "A Prioritization of Generic Safety Issues"),” December 2011. ADAMS Accession No. ML11353A382.

39. U.S. Nuclear Regulatory Commission, NUREG-1430, “Standard Technical Specifications — Babcock and Wilcox Plants.” April 2012. ADAMS Accession No. ML12100A177 and ML12100A178.

40. U.S. Nuclear Regulatory Commission, NUREG-1431, “Standard Technical Specifications — Westinghouse Plants.” April 2012. ADAMS Accession No. ML12100A222 and ML12100A228.

41. U.S. Nuclear Regulatory Commission, NUREG-1432, “Standard Technical Specifications — Combustion Engineering Plants.” April 2012. ADAMS Accession No. ML12102A165 and ML12102A169.

42. U.S. Nuclear Regulatory Commission, NUREG-1433, “Standard Technical Specifications — General Electric Plants (BWR/4).” April 2012. ADAMS Accession No. ML12104A192 and ML12104A193.

43. U.S. Nuclear Regulatory Commission, NUREG-1434, “Standard Technical Specifications — General Electric Plants (BWR/6).” April 2012. ADAMS Accession No. ML12104A195 and ML12104A196.

44. U.S. Nuclear Regulatory Commission, “Instrument Lines Penetrating Primary Reactor Containment (Safety Guide 11),” Regulatory Guide 1.11. Revision 1. ADAMS Accession No. ML100250396.

45. U.S. Nuclear Regulatory Commission, “Guidance on Monitoring and Responding to Reactor Coolant System Leakage,” Regulatory Guide 1.45. ADAMS Accession No. ML073200271.

46. U.S. Nuclear Regulatory Commission, “Initial Test Programs for Water-Cooled Nuclear Power Plants,” Regulatory Guide 1.68. ADAMS Accession No. ML13051A027.

47. U.S. Nuclear Regulatory Commission, “Emergency Planning and Preparedness for Nuclear Power Reactors,” Regulatory Guide 1.101. ADAMS Accession No. ML050730286.

48. U.S. Nuclear Regulatory Commission, “Instrument Sensing Lines,” Regulatory Guide 1.151, ADAMS Accession No. ML092330219.

49. U.S. Nuclear Regulatory Commission, “Monitoring the Effectiveness of Maintenance at Nuclear Power Plants,” Regulatory Guide 1.160, ADAMS Accession No. ML13210A432. (RG 1.160 supersedes RG 1.182, issued May 2000.)

50. U.S. Nuclear Regulatory Commission, “Guidance for Implementation of 10 CFR 50.59 Changes, Tests, and Experiments,” Regulatory Guide 1.187. ADAMS Accession No. ML003759710.

51. U.S. Nuclear Regulatory Commission, “Quality Assurance for Radiological Monitoring Programs (Inception through Operations to License Termination) – Effluent Streams and the Environment,” Regulatory Guide 4.15. Revision 2, July 2007. ADAMS Accession No. ML071790506.

52. U.S. Nuclear Regulatory Commission, “Minimization of Contamination and Radioactive Waste Generation: Life-Cycle Planning,” Regulatory Guide 4.21. June 2008. ADAMS Accession No. ML082120212.

53. U.S. Nuclear Regulatory Commission, “Decommissioning Planning During Operations,” Regulatory Guide 4.22. ADAMS Accession No. ML12158A361.

54. U.S. Nuclear Regulatory Commission, RIS 2007-20, “Implementation of Primary-to-Secondary Leakage Performance Criteria.” August 23, 2007. ADAMS Accession No. ML070570297.

55. U.S. Nuclear Regulatory Commission, RIS 2008-03, “Return/Re-use of Previously Discharged Radioactive Effluents.” February 13, 2008. ADAMS Accession No. ML072120368.

56. U.S. Nuclear Regulatory Commission, RIS 2009-02, “Use of Containment Atmosphere Gaseous Radioactivity Monitors as Reactor Coolant System Leakage Detection Equipment at Nuclear Power Reactors.” January 29, 2009, with Revision 1 issued, May 8, 2009. ADAMS Accession No. ML090120669.

57. U.S. Nuclear Regulatory Commission, “Review of Operational Programs in a Combined License Application and Generic Emergency Planning Inspections, Tests, Analyses, and Acceptance Criteria,” SECY-05-0197. ADAMS Accession No. ML052770257.